

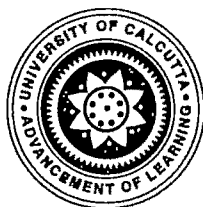
RECENT TRENDS IN HUMAN BIOLOGY



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Preface

Anthropology was introduced in India by the British rulers in the nineteenth century for administrative purposes. But Anthropology as a discipline with independent departmental status was founded in the University of Calcutta in 1920. This department is the oldest one in the country and one of the oldest in Asia.

Research work of this Department by the faculties like T.C. Das, T.C. Roy Chowdhury, A. N. Chatterjee, M.N. Basu, D. Sen, S.S. Sarkar and others placed the Department in the academic map of the world. The contribution in Physical/Biological Anthropology by the faculties of this Department can be summarised in the following major areas.

1. Application of statistical methods in anthropological research (K.P. Chattopadhyay, 1951).
 2. Racial classification of Indian population and racial migration in India (S. S. Sarkar, 1958, 1953).
 3. ABO blood group polymorphism and natural selection (A.R. Banerjee, 1988-1989).
 4. Quantitative genetics in twins and family study (A. B. Das Chaudhuri, 1982).
- In the last few years researches on two new areas were taken. These are :—
5. Occupational and environmental exposure to lead pollution in human population groups (Das Chaudhuri and Co-Workers, 2000).
 6. Body composition relating to health and diseases (Das Chaudhuri and Co-Workers 2000, 2001)

As we know very well that human biology is about men rather than man, about their origin and evolution, about the growth and development of human populations, their structure in space and time; it deals with human heredity. For comprehensive understanding of human biology the conjunctive approach with major aspects of anatomy, physiology, growth, genetics, evolution and ecology of men should be taken into consideration.

In Indian scenario, works on human biology covering the aspects of genetics and growth have been done by research workers in major universities of northern India, southern India and in few research institutions of India. Of course in future, we need more qualitative and analytical researches in these areas. Researches on evolution, anatomy, physiology and ecology by human biologists are inadequate and few. The new syllabus in Anthropology recommended by the University Grants Commission has incorporated all these aspects.

In our new and revised syllabus, we have incorporated all these areas and an attempt has been made for building up the infrastructure under UGC-DRS and UGC-DSA programme for teaching and research in these areas. In the world scenario, recent developments in the human genome project have had an enormous impact on our understanding of human evolution and history, through both population genetics studies of present day populations and ancient DNA analysis. Today, at the beginning of 21st century, when we have entered the post genomic era, this is the right time to consider about the future projection of researches.

Along with different aspects of human biology, as I mentioned earlier, I can foresee in this millennium researches on the following four areas will get priority :

1. Human genome diversity programme i.e. evaluation of human diversity on a worldwide basis and
2. Body composition relating to health and diseases
3. Etiology of complex diseases
4. Gene and diseases

The outcome of the results of the above mentioned areas could be used for benefit and welfare of men. Thus human biology would help us to assure for continued survival as individuals and species.

The present seminar is the first of its kind in the history of the Department although this is considered to be a preliminary attempt. From the content of the proceedings the inclusion of the papers under six different broad topical areas may appear sometimes inappropriate. In this regard the editor has no alternative, as number of papers presented in the seminar by participants were finally not submitted in stipulated time. Partial success of this seminar is achieved in understanding the recent trends in human biology. The total number of eleven papers, contributed by different authors, relating to six topical areas corroborates this statement.

For the publication of the work, the generous financial assistance received from the DSA Phase II (2001-2002), UGC Programme of the Department of Anthropology under the Chairmanship of the Vice-Chancellor, University of Calcutta is gratefully acknowledged. Thanks are due to the Co-ordinator, DSA Phase II, and UGC Programme for providing able assistance in publication of these proceedings.

I wish to express my thanks to all faculty members for making this publication of the proceedings of the seminar a reality. The editor is especially thankful to Dr. A.R. Bandyopadhyay who untiringly cooperated in all academic and organizational activities at every stage of the Seminar. The names of research scholars, Dr. Indrajit Dasgupta and Dr. Arnab Ghosh and students Sri Suman Chakraborty and Sarbasish Roy are to be specially mentioned for their able assistance throughout the seminar. My thanks go also to the students and staff members of the department who unstintingly lent their support for the smooth operation of the seminar.

A. B. Das Chaudhuri

A note from the desk of the coordinator, Departmental Special Assistance (UGC), Phase II

Department of Anthropology, the oldest in Asia, has got a legacy of teaching and research on urgent issues related to mankind. In the past eight decades under the leadership of renowned scholars, valuable contributions were made not only in the field of Anthropology but also in the planning and welfare work of the nation. Throughout this time the department has modified its curriculum and teaching methods according to the need for betterment, modernisation and applied value of the subject, arising out of the concern for the well being of mankind.

Subsequently in 1994, the University Grants Commission selected the department for special assistance programme. After successful completion of phase I of the assistance, phase II was sanctioned in 1999. Broad thrust area identified for research was 'Man and Environment'. Within this special emphasis was given on women, weaker sections of society and prominent and senior citizens. Each of the faculty members submitted research proposal in the thrust area and had them approved in the advisory body. The topics on which researches are carried out are as follows :

1. Adiposity, Obesity and Hypertension study of Post-Pubertal schoolboys of Calcutta.
2. X Chromatin and Chromosome examination in aged women.
3. Nature of Criminality among the tribal population in India : A Review from the View Point of mainstream idea of Criminality.
4. Socio-Economic study among the fishing communities of south 24 pgs of the Sunderban area.
5. Consequence of ageing in a tribal community.
6. Women and Development : Problems of Educational Development in South Asia.
7. Quality of life of the weaker sections including minority communities in varied ecozones of West Bengal.
8. Folk classification of environment resources for sustainable development.
9. From agricultural field to market : Transformation of peasantry in West Bengal villages.
10. A study on reproductive performances of Santal females of Eastern India.

Grant was allocated for seminar. Three seminars were held in the subsequent three years. Proceeding of the first two seminars were published. On the third year, seminar topic had a focus on the recent trends in Human Biology. There was no deviation from the thrust area identified. Topical areas for the seminar were genetic polymorphism and variation, auxology, women studies, forensic application, demography, bio-cultural interaction and ageing. With the allocated grant for publication eleven papers are published in this volume.

In Anthropology, biology cannot be separated from the social cultural aspects. The broad title, "Recent trends in Human Biology" includes papers, which are truly

anthropological in their material, method and treatment. A summary of the research results of the papers included in this volume is given below.

Under the subheading of genetic polymorphism and variation, there are three papers. The paper by Sengupta and Karmakar shows that correlation and coefficient between hands and feet of the same individual indicate positive relationship. The conclusion is that the two dermatoglyphic regions are controlled by a common set of factors. The differential trends may have been due to delayed embryonic process in toes.

Paper by Chatterjee and Bandhyopadhyay is on segregation distortion of ABO blood group among the Bengalee population. 2750 individuals were studied. Evidence for distortion in segregation ratio is marked among children and parent and in incompatible mating.

Sen discussed the process and factors that influence trace element concentration in human hair.

The other group of papers is on auxology, the study of growth. Saha, Sinha and Dasgupta have mainly concentrated on the nutritional status based on subcutaneous fat of Bengalee boys between 7 to 16 years of age. Kaul and Bhalla, former an anthropologist and the latter a physician concentrated on infant growth. Distance and velocity percentile curves are used for understanding growth in the first year of infancy through monthly increments among Punjabi infants. It has been found that the growth is age independent.

The third group of papers is on women, basically on their fertility and health care. Modal and Das Chaudhuri used the traditional anthropological technique in combination with clinical method in their fertility study. Anthropometric measurements were taken of 50 women from a middle-income group of people living in MIG housing at Kalindi. Correlation is made of individual's hormone level with their postcephalic breadth and circumference. It was found that hormone levels and body dimensions were significant among the 50 fertile women of Kolkata.

Basu, Chatterjee and Ray made a study of health care among the tribe Bathudi, living within the Simlipal Reserve Forest. The inadequate health care received from modern facilities and dependence on the traditional ways is the hallmark of these women, who live in the proximity of forest, away from urban centres.

Ghoshal dealt with mothers who have given birth to children with congenital defects. The study is done among Bengalee Hindu population. It was found that mothers having children who have survived with defects have lower pregnancy rate than those who have severe congenital defect and death of such offsprings at infancy. The study gave emphasis on emotional, physical and financial stress for such variation in family planning practices.

There is only one paper by Chakraborty, which dealt with forensic application. This is more in the domain of ergonomics. In view of injuries to the thumb and index finger of the jute mill workers special gloves were designed for the protection of their hands.

The study shows that through ergonomics strategies may be offered as preventive measures, which may cater for mass produce with less amount of injuries.

Mondal's paper may be classed under demography and bio-cultural interactions. He made an attempt at establishing that nearness to urban centres produce better health care systems. The study is made among Namasudras of North 24 Parganas. A comparison was done of the health care pattern in three villages within the district. Two of them were near to urban health care facilities and one was farthest from the health care centres.

Sengupta's paper is categorized as on ageing. It dealt with the cognitive value of the tribes, on food and health. Data were collected from the three villages of Ghatshila area, in East Singhbhum, Jharkhand from the tribes, Santar and Ho. It has been suggested that folk consider ageing as a process and they have the knowledge on the type and kind of food necessary for people at their old age. This may have important bearing on ethnic concept and knowledge.

All the eleven papers give a glimpse of the research that is being done in Biological anthropology. At the same time it may be mentioned that important contributions are made in similar manner on other aspects of Anthropology and for the well being of human race.

Ranjana Ray

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A Comparative study of the pattern expression in fingers and toes among the 'Santals' of Purulia, West Bengal

MAHUA SENGUPTA AND BIBHA KARMAKAR*

Abstract : In order to compare the qualitative pattern expression between fingers and toes, bilateral prints of 100 Santals (50 males and 50 females) were collected from Purulia, West Bengal. The most important finding is that, in both sexes, from fingers to toes the arches (most reduced pattern) increase with the decrease of whorls. But this reduction is not evenly distributed over all the toes. Though heterogeneity exists in digit-wise pattern expression between hands and feet, unequal pattern distribution of the two sides of feet shows the same trend as found in hands. The correlation coefficients between hands and feet of the same individual also indicate significant positive relationship. Thus it may be concluded that both the two dermatoglyphic regions may be controlled by a common set of factors, but the delayed embryonic process in toes may have caused this differential trend of pattern reduction in fingers and toes.

Key Words : finger; toe dermatoglyphics; Santal; Purulia; West Bengal.

Running Title : Comparison of finger and toe patterns of Santal.

'The comparative study of finger and toe dermatoglyphics can reveal the genetic interdependence and the differential effect of their independent course of evolutionary specialization' (Balli, 1966). In general, it has been suggested that dermatoglyphics of hand and foot agree closely with developmental sequences of the embryo. Some studies (MacArthur, 1938; Newman, 1936) support that there is a dermatoglyphic correlation between the fingers and toes of the same individuals. According to Davenport (1933) the factors, which control the terminal segments of the appendages, are probably the same and both hand and foot grow together and increase with age. Cummins and Midlo (1961) also suggest that '.....even more distant pattern areas of the palm and sole may not be completely independent of each other'.

Although the toe dermatoglyphics could have been used in racial variation, personal identification, evolutionary and genetical studies, they have received little attention probably due to difficulty in securing adequate prints and also due to time-consuming procedure. Some studies (Balli, 1973; Das Sharma, 1977; Tiwary and Kapoor, 1983; Kshatriya and Kapoor, 1985; Mitra and Singhol, 1991) were conducted on only plantar dermatoglyphics, but no serious attempt has been made to find out the relationships between finger and toe dermatoglyphics and the data are still inadequate for a comprehensive nature of relationship, specially in India (Sharma, 1966; Balli, 1967; Mukherjee, 1971) as well as in other countries (Takeya, 1933; Newman, 1936; Steffens, 1938; Orczykowaska, 1971; Fox and Plato, 1987). The main objectives of the present study are, therefore, to understand: (i) the qualitative difference between finger and toe patterns with respect to sex, and (ii) degree of correlation in the pattern expression of fingers and toes of the same individual.

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The tribe 'Santal' has been extensively studied by various authors from their sociological (Sachidananda, 1978; Singh and Singh, 1982; Singh, 1988; Kapoor and Kshatriya, 2000), psychological (Sing and Sinha, 1982; Sing et al., 1985; Narain and Laxmi, 1994) and other biological aspects (Chaudhuri et al., 1967; Giri et al., 1982; Poulton et al., 1987; Saha et al., 1992; Balgir et al., 1999; Krishnaveni and Srinivasa, 2000) compared to their dermatoglyphic characters (Biswas, 1955; Sarkar and Banerjee, 1957; Chakravarti, 1960; Chakravarti and Mukherjee, 1964; Basu et al. 1978). It is, therefore, felt desirable to attempt a dermatoglyphic study particularly the comparative study of finger and toe pattern within this tribal group.

Materials and Methods

The sample is constituted of bilateral finger and toe prints of 100 normal healthy individuals (50 males and 50 females). All are belonging to an ethnically homogeneous population, 'Santal', inhabited in Bankwan village of Purulia district, West Bengal. From the physical characteristics, the tribe Santal may be regarded as a typical example of the pure Dravidian stock (Chaudhuri, 1989). They are mostly found in Chhotonagpur plateau, North Orissa and West Bengal and classed on linguistic grounds as 'Kolarian'. However, care was taken to have random sampling so that a representative of the stock may be obtained. The results of the analyses are stated separately for the two sexes, so that intersex difference, if any, may be shown regarding the distribution of patterns. For this reason equal number of males and females have been examined.

The prints were collected by means of traditional ink method proposed by Cummins and Midlo (1961). The finger and toe patterns have been classified into three major categories: 'Whorls', 'Loops' and 'Arches' (Galton, 1982). All types of true whorls like concentric, single spiral, double spiral, almost shaped, accidental etc. and also all types of composite whorls like twin loops, central pocket loops, lateral pocket loops, crested and knot-crested loops are grouped under the broad category of 'whorls'. On the other hand radial and ulnar loops for finger and tibial and fibular loops for toes are categorized into 'loops'; both simple and tented arches are grouped into the category 'arches'. Thus these three groups will represent an all over picture of the pattern distribution in fingers and toes.

For analysis of data, χ^2 test, G-test for heterogeneity (Woolf, 1957) with Williams's correction (Williams, 1976) and tetrachoric correlation (Spiegel, 1988) have been employed.

Results

The distributions of pattern frequencies between the fingers and toes have been presented in Table 1 and graphically in Fig. 1. For the males, the incidence of whorls in fingers and toes are 55% and 21.6%, respectively; while for females these are 47.8% and 16.4%, respectively. Thus males indicate higher incidence of whorls both in fingers and toes as compared to females. But the arches exhibit the reverse trend in their distribution; the frequencies being male fingers 3.6% and toes 27% and female fingers 3.8% and toes 28.2%. For loops also, female fingers (48.4%) and toes (55%) show higher frequency than male fingers (41.4%) and toes (51.4%). The differences between two sexes are not statistically significant (for fingers, $\chi^2 = 5.28$; for toes, $\chi^2 = 4.44$). In both sexes, there appear some

characteristic peculiarities in the distribution of pattern. It is to be noted that, the arches are more frequent in toes than in fingers; while whorls are more frequent in fingers than toes. Thus there appears to be an inverse relationship between the occurrence of whorls and arches in fingers and toes. On the other hand loops occur more or less in equal frequency in fingers and toes.

Table 2 shows digit-wise distribution of three major patterns of fingers (Fig. 2a) and toes (Fig. 2b) of right and left sides among males. Toe I bears the largest number of loops (66%). Finger II shows the highest frequency of arches (12%) and finger III shows the highest frequency of loops (59%). Toe III shows striking distribution of pattern types. It is the site of maximum frequency of whorls (56%) and least frequency of arches (6%). For digit IV the frequency of whorls on toes (18%) is much less as compared to fingers (73%). Digit V exhibits absolute reduction in the expression of toe patterns as compared to fingers. A large number of arches (59%) and smaller whorls (10%) have been observed on toe V. When we combined all five digits for each side separately, it reveals that, in both sexes arches and whorls are predominated on left hand (Arch 4.4%, Whorl 55.2%) and left feet (Arch 29.6%, Whorl 21.6%) while loops predominate on right hand (42.4%) and right feet (54%).

Table 3 shows digit-wise distribution of the patterns on fingers (Fig. 3a) and toes (Fig. 3b) of right and left sides among females. More or less the same trend has been observed in case of female also. Only the highest number of loops in toes has been observed in digit II (78%) instead of digit I (74%). Just like males, females also show that arches and whorls are predominated on left hand (Arch 4.4%, Whorl 51.2%) over right hand (Arch 3.2 % and Whorl 44.4%); and loops are predominated on right hand (52.4%) over left hand (44.4%). Just the same trend in the expression of pattern on toes is observed.

G-test has been carried out (Table 4) for understanding the heterogeneity between fingers and toes with respect to the pattern distribution of homolateral and heterolateral digits separately. In both sexes, the values are statistically significant, indicating heterogeneity in digit-wise pattern distribution between hands and feet, with exception in finger I vs. toe III (Male 0.49, Female 3.60) and finger II vs. toe III (Male 4.08, Female 0.71). Actually, toe III shows the lowest heterogeneity while toe V shows the highest heterogeneity with all five fingers. From this table it is also observed that females show higher G-value than males for most of the cases.

Though heterogeneity observed in digit-wise pattern distribution between fingers and toes, there still exists a possibility of having intra-individual correlation in pattern expression between fingers and toes of separate hands and feet as well as total digits of hands and total digits of feet: In both sexes, the values of 'tetrachoric' correlation (Table 5) between hands and feet of separate side are lower but most of them are statistically significant, especially with regard to whorls and arches. The degrees of correlation between all fingers and all toes of the same individual are statistically significant at 1% level both for male (Whorl 0.486, Loop 0.142, Arch 0.325) and female (Whorl 0.476, Loop 0.099, Arch 0.471).

Discussion

The tribe Santal shows more or less the similar result as obtained in the previous

studies conducted on the caste groups of Indian populations. When the ten digits are combined it is noted that, from fingers to toes the arches (the most reduced pattern) increase with the decrease of whorls (the most highly expressed patterns); while loops moderating effect on the total frequency of patterns both in fingers and toes. It indicates that there is a suppression or reduction in pattern expression in toes as compared to fingers. This is probably due to the fact that comparatively late and slow embryonic development of foot than hand suppressed the pattern expression on the toes (Newman, 1936). If ridge pattern is indeed determined by the topography of the volar pad at the time of ridge formation, as has been suggested by Mulvihill and Smith (1969), then early ridge formation should be associated with whorls. Secondly, 'while the finger patterns are high and well-vaulted type, toe patterns are low and frequently so spread out laterally as to extend to the sides of the toe and to fade out on the ridgeless skin' (Newman, 1936). Unlike the hand and foot of other primates, the human foot has practically lost the power of grasping and is engaged for extremely different function. Human sole may, therefore, be showing departure in pattern expression.

There are some theories regarding the development of pattern formation. Fere (1893) proposed the "pressure theory" for the formation of patterns and suggests that 'the areas where greatest pressure is exerted does not indicate pattern-form'. He cited the heel in the foot, as an example, where due to exertion of greater pressure pattern never appears. Hepburn (1895) proposed a "friction theory" which supports the pressure theory of Fere by citing the functional use of prehensile monkey's tail, which bears transverse ridges. There is, however, non-significant sex difference in the pattern expression of hand and foot.

Another interesting finding is that, this reduction in pattern expression on toes is not equally distributed on the ten digits. While digit III shows the largest percentage of highly expressed patterns (whorls), digit V shows the highest percentage of reduced patterns (arches). For this reason, toe III shows the lowest heterogeneity while toe V shows the highest heterogeneity with fingers, as higher G-value between fingers and toes is at least partly due to the greater reduction of patterns in the toes. Bali (1973) also found such unequal distribution of pattern and suggested that, two factors may be responsible for this differential distribution of pattern reduction in different toes. These are : i) the medial-ward shift of the human foot has increased the pattern reduction on toe V and IV, because this area is more affected under the functional stresses of bipedal locomotion, and ii) due to erect posture, the medial-ward pressure on the foot activated the pattern reduction of toe I and toe II. Thus under the effect of these two factors, toe III is least affected and shows minimum tendency of pattern reduction.

Though there exists heterogeneity in digit-wise pattern distribution between hand and foot, they show similar trend in the expression of pattern, such as both of them show that whorls and arches are predominated on left sides over right sides whereas loops are on right sides over left sides. Sharma (1966) also found that the unequal pattern distribution of the two sides in toe show more or less same direction as found in fingers of Lahulis of Punjab. However, in the present study, when correlation was calculated between hands and feet of homolateral and heterolateral sides, they reveal slightly lower but mostly significant value. The degrees of correlation between all fingers and all toes of the same

individual are also statistically significant. It is, therefore, clear that there exists a positive correlation between the finger and toe prints.

Thus looking over the aforementioned analyses, we may support the hypothesis of Bali (1967) that the two dermatoglyphic regions (fingers and toes), may have control of common set of factor; but the delayed embryonic process in toes as compared to fingers and independent courses of specialization in evolution may have caused this differential trend of pattern reduction in toes and fingers.

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Table 1 : Distribution of three patterns in finger and toes

Patterns		Male		Female	
		Fingers	Toes	Fingers	Toes
Arches	Ab	18	135	19	141
	%	3.6	27.0	3.8	28.2
Loops	Ab	207	257	242	277
	%	41.4	51.4	48.4	55.4
Whorls	Ab	275	108	239	82
	%	55.0	21.6	47.8	16.4

Sex difference : fingers, $\chi^2 = 5.28$, $p > 0.05$; toes, $\chi^2 = 4.44$, $p > 0.05$

Table 2 : Digit-wise distribution of three primary patterns on fingers and toes (Males)

Digits		Fingers						Toes					
		Whorl		Loop		Arch		Whorl		Loop		Arch	
		Ab	%	Ab	%	Ab	%	Ab	%	Ab	%	Ab	%
I	R	32	64.0	17	34.0	1	2.0	5	10.0	35	70.0	10	20.0
	L	27	34.0	20	40.0	3	6.0	7	14.0	31	62.0	12	24.0
	R+L	59	59.0	37	37.0	4	4.0	12	12.0	66	66.0	22	44.0
II	R	33	66.0	11	22.0	6	12.0	9	18.0	33	66.0	8	16.0
	L	28	56.0	16	32.0	6	12.0	12	24.0	26	32.0	12	24.0
	R+L	61	61.0	27	27.0	12	12.0	21	21.0	59	59.0	20	20.0
III	R	16	32.0	34	68.0	...	...	30	60.0	18	36.0	2	4.0
	L	23	46.0	25	50.0	2	4.0	26	52.0	20	40.0	4	8.0
	R+L	39	39.0	59	59.0	2	2.0	56	56.0	38	38.0	6	6.0
IV	R	38	76.0	12	24.0	...	...	9	18.0	28	56.0	13	26.0
	L	35	70.0	15	30.0	...	...	9	18.0	26	52.0	15	30.0
	R+L	73	73.0	27	27.0	...	...	18	18.0	54	54.0	28	56.0
V	R	18	36.0	32	64.0	...	...	1	2.0	21	42.0	28	56.0
	L	25	50.0	25	50.0	...	...	...	...	19	38.0	31	62.0
	R+L	43	43.0	57	57.0	...	...	1	1.0	40	40.0	59	59.0
Total	R	137	54.8	106	42.4	7	2.8	54	21.6	135	54.0	61	24.4
	L	138	55.2	101	40.4	11	4.4	54	21.6	122	48.8	74	29.6
	R+L	275	55.0	207	41.4	18	3.6	108	21.6	257	51.4	135	27.0

Ab = Absolute number; R = Right; L = Left.

Table 3 : Digit-wise distribution of three primary patterns on fingers and toes (Females)

Digits		Fingers						Toes					
		Whorl		Loop		Arch		Whorl		Loop		Arch	
		Ab	%	Ab	%	Ab	%	Ab	%	Ab	%	Ab	%
I	R	29	58.0	20	40.0	1	2.0	...	...	38	76.0	12	24.0
	L	29	58.0	19	38.0	2	4.0	1	2.0	36	72.0	13	26.0
	R+L	58	58.0	39	39.0	3	3.0	1	1.0	74	74.0	25	25.0
II	R	23	46.0	23	46.0	4	8.0	6	12.0	41	82.0	3	6.0
	L	27	54.0	17	34.0	6	12.0	8	16.0	37	74.0	5	10.0
	R+L	50	50.0	40	40.0	10	10.0	14	14.0	78	78.0	8	8.0
III	R	11	22.0	37	74.0	2	4.0	31	62.0	17	34.0	2	4.0
	L	19	38.0	28	56.0	3	6.0	27	54.0	16	32.0	7	14.0
	R+L	30	30.0	65	65.0	5	5.0	58	58.0	33	33.0	9	9.0
IV	R	34	68.0	15	30.0	1	2.0	4	8.0	35	70.0	11	22.0
	L	38	76.0	12	24.0	...	...	5	10.0	26	26.0	19	38.0
	R+L	72	72.0	27	27.0	1	1.0	9	9.0	61	61.0	30	30.0
V	R	14	28.0	36	72.0	...	...	...	...	18	36.0	31	64.0
	L	15	30.0	35	70.0	...	...	...	...	13	26.0	37	74.0
	R+L	29	29.0	71	71.0	...	...	...	...	31	31.0	68	68.0
Total	R	111	44.4	131	52.4	8	3.2	41	16.4	149	59.6	60	24.0
	L	128	51.2	111	44.4	11	4.4	41	16.4	128	51.2	81	32.4
	R+L	239	47.8	242	48.4	19	3.8	82	16.4	277	55.4	141	28.2

Ab = Absolute number; R = Right; L = Left.

Table 4 : G-values between fingers and toes with respect to three patterns (R+L)

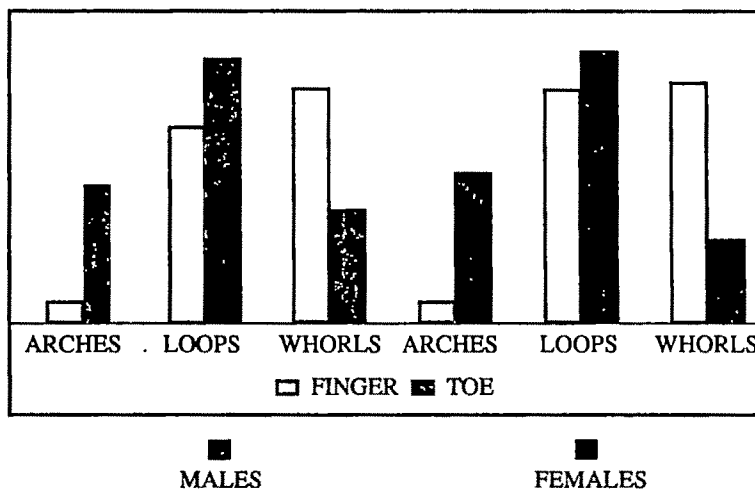
		T		O	E	S
		I	II	III	IV	V
<u>MALE</u>						
F	I	55.35**	35.18**	0.49	45.98**	129.37**
	II	55.26**	34.25**	4.08	40.08**	154.75**
	III	34.60**	22.36**	9.63**	34.69**	116.63**
	IV	95.05**	69.68**	12.31**	82.80**	174.58**
	V	49.22**	34.93**	13.72**	48.96**	134.89**
<u>FEMALE</u>						
G	I	101.41**	44.05**	3.60	78.68**	154.65**
	II	77.01**	33.82**	0.71	51.49**	118.53**
	III	48.79**	20.66**	7.76*	44.17**	118.69**
	IV	139.54**	74.11**	9.38*	109.62**	184.80**
	V	66.87**	16.60**	36.18**	69.13**	150.47**

* $P < 0.05$; ** $P < 0.01$; R = Right; L = Left.

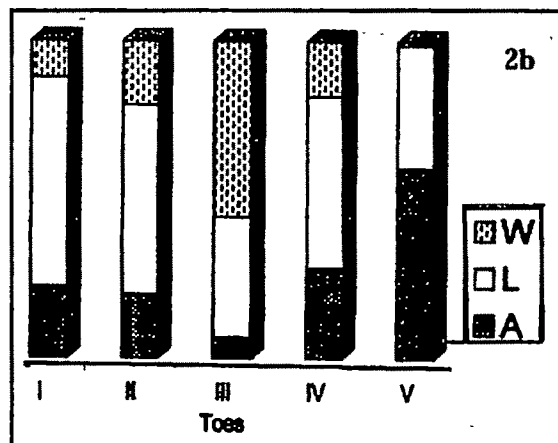
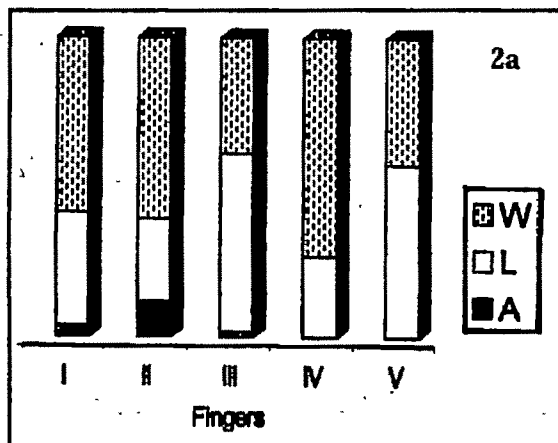
Table 5 : Intra-individual correlation of pattern expression between hand and foot.

			Male			Female		
			H	A	N	D	S	
			Whorl					
			R	L	R + L	R	L	R + L
F	Whorl	R	0.342**	0.345**	....	0.304**	0.368**	....
		L	0.342**	0.345**	....	0.304**	0.368**	....
		R+L	....	....	0.486**	....	....	0.476**
			Loop					
			R	L	R + L	R	L	R + L
E	Loop	R	0.096**	0.136**	....	0.073	0.152**	....
		L	0.064**	0.084**	....	0.012	0.068	....
		R+L	....	....	0.142**	....	....	0.099**
			Arch					
			R	L	R + L	R	L	R + L
T	Arch	R	0.135**	0.285**	....	0.303**	0.382**	....
		L	0.364**	0.335**	....	0.281**	0.361**	....
		R+L	....	....	0.325**	....	....	0.471**

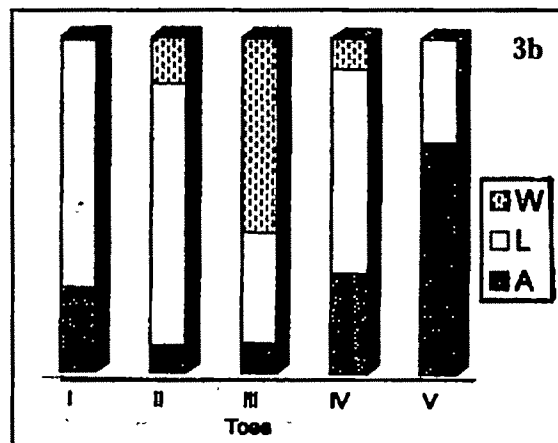
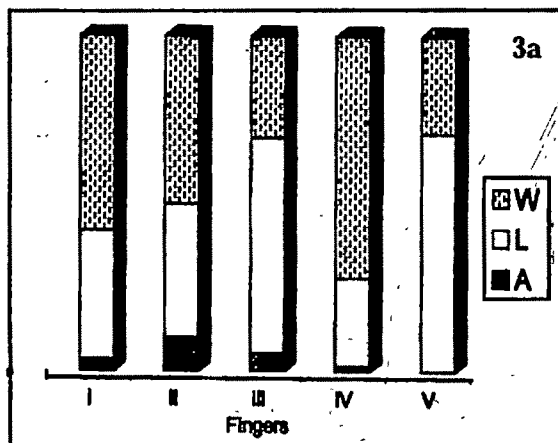
* P < 0.05; ** P < 0.01; R = Right; L = Left.



Figs. 1. Distrubtion of pattern types in fingers and toes



Figs. 2a and 2b. Digit-wise distribution of main three patterns (males).
W = Whorls; L = Loops; A = Arches.



Figs. 3a and 3b. Digit-wise distribution of main three patterns (females).
W = Whorls; L = Loops; A = Arches.

A study on segregation distortion of ABO blood groups in the Bengalee population

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Abstract : In the present study an attempt has been made to understand the extent of segregation distortion in the Bengalee population. For this purpose 2750 individuals comprising of 1632 couples and their 1118 children were taken into consideration. A significant ($P < 0.05$) segregation distortion was evident among the O and non-O children born in reciprocal O and non-O mating types. Moreover, deficiency of non-O children relative to O children in incompatible mating compared to those in compatible one was significant ($P < 0.05$). The present study also revealed a significant deviation ($P < 0.05$) from the expected among the children due to distortion in segregation ratio of ABO blood groups in parental incompatible mating. However, magnitude of the deviation from the expected was evident in O mother and A father compared to O mother and B father. Elimination of incompatible genotypes as expected brought significant ($P < 0.05$) inconsistency in the distribution of ABO blood groups among the parents and the children.

Key words : Segregation distortion; ABO blood groups; Bengalee population.

Introduction

The ABO blood groups are studied first with considerable details because it was the first human blood groups that had been identified, and are still most important. Since the publication of Dienst (1905) the problem concerning the elimination of blood group genes had been the subject matter of a number of authors. Levine & Rosenfield (1961) have provided a highly critical appraisal on the subject. In later years Mourant et al. (1978), Clegg (1979) and Vogel and Motulski (1997) have updated the observations on the matter.

Three principle but not mutually exclusive mechanism namely, mortality of the genotypes (Levine et al, 1941; Weiner 1942; Haldane, 1942; Ford 1940; Aird et al, 1953 1954; Clark et al, 1955; Bandyopadhyay 1992; Bottini et al. 2001); distortion of segregation of different blood groups (Hirstzfield and Zborowski, 1925; Waterhouse and Hogben 1947; Kirk et al 1955; Bottini et al. 2001; Hoff and Bixler 1986; Bottini and Santeusanio 1998) and differential fertility of different genotypes (Matsunaga and Itoh 1955; Johnston, 1954; Matsunaga et al. 1962; Behrman et al 1960; Nag and Banerjee 1976) were thought to be responsible for the maintenance of polymorphism in blood groups specially of the ABO system (Solish 1969; Cavalli-Sforza and Bodmer, 1971).

Distortion of segregation ratio in blood group among the offspring is accounted as one of the unequivocal evidence of system in utero. Moreover, it is also indicative of prezygotic selection, i.e. preferential transmission of certain gametes carrying ABO gene, which has been referred to as mitotic drive by Matsunaga et al. (1962) and Hiraizumi (1964).

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Distortion of segregation ratio in the form of deficiency of an offspring in mating between O mother and A father was firmly noted by Hirzfield and Zborowski (1925) and accounted it as due to ABO incompatibility selection in utero. This was later found to be applicable also to other six types of ABO incompatible mating (Waterhouse and Hogben 1947; Johnstone 1954; Kirk et al 1953). In subsequent years in most of the studies on ABO incompatibility foetal wastage was found to be much higher among O group mothers than mothers belonging to other groups (Wren and Vos 1962; Morton et al. 1966; Matsunaga and Itoh 1958; Kircher 1972; Bottini et al. 1998, 2001). In connection with Indian samples Chakravarti and Chakravarti (1977); Satyarayan et al. (1978); Banerjee and Das (1986); Banerjee (1989); Bandyopadhyay (1992) and Banerjee et al. (1996) found definite evidence for prenatal and perinatal selection due to ABO incompatibility.

In view of the above mentioned consideration in the present study, data comprising of 2750 individuals comprising of 1118 offspring and 1632 parents (mother 816 and father 816) has been undertaken to examine the extent of segregation distortion due to the different parental mating patterns. To best of our knowledge no study has so far been conducted in West Bengal, India with regard to segregation distortion in ABO blood group on the basis of family studies with more than one child.

Materials and Methods

Blood samples for the present study comprised of 2750 individuals comprising of 1118 offspring and 1632 parents and have been collected from different families of Bengalee Hindu caste groups of Bally, Howrah, Barrackpore and 24 Pgs. (N).

The blood samples for the present study were collected by finger puncture in EDTA vials. Immediately after the collection of blood samples, it has been transported to Human Genetic Laboratory, Department of Anthropology, University of Calcutta in ice-bucket. Along with the blood samples detailed biosocial information, specially regarding the reproductive performances and others were collected by a specially prepared pre-tested scheduled.

ABO and Rh (D) blood groupings were performed following the standard method (Boormen et al. 1977, Prokop and Gohler 1986) by agglutination test. Moreover, the instruction manual of the Anti-sera Production Company (Eryscreen plus, Tulip) was strictly followed.

Allele frequency for ABO blood group was computed by MLH (Maximum Likelihood Estimation) estimation following Vogel and Motulski (1997) and Mourant et al. (1978). Chi² test (Madrigal, 1998) has been applied for the examination of goodness of fit to the expected phenotypes (Sinock and Singh, 1972).

Results and Discussion

Distribution of ABO blood groups and their allele frequencies among 1118 children and their parents are presented in Table 1. No heterogeneity in distribution of blood groups among the parents ($\chi^2 = 4.44$, 2 d.f., $P > 0.05$) and as well as no sex difference ($\chi^2 = 2.97$, 3 d.f., $P > 0.05$) was observed. Examination on the distribution of ABO blood groups revealed a significant ($\chi^2 = 10.25$, 3d.f., $p < 0.05$) excess of O allele with decrease

A and B allele in the children compared to their parents. The distribution of the ABO blood groups was, however, almost corroborative with other published data on Bengalee population (Banerjee et al. 1996, Chakraborty et al. 1986, Bandyopadhyay 1992, 1993, Bandopadhyay et al. 1994).

Segregation of ABO blood group among the children classified according to ABO compatible and ABO incompatible mating types of their parents has been presented in Table 2. Allele frequencies of A and B children were found to be significantly lower ($\chi^2 = 17.99$, 3 d.f., $P < 0.001$) in incompatible mating types than those in children born in compatible ones. Allele frequencies of O children were remaining almost same in both categories of the parental Combinations. Incidences of incompatibility were 41.45% which is slightly higher than earlier studies on Bengalee population (Bandopadhaya 1992, 1993, Banerjee et al. 1996).

The distribution of segregation ratio of the children born in the reciprocal parental mating types of the parents for O and Non-O (A/B/AB) blood groups is presented in Table 3. Examination on the analysis for segregation revealed significant deficit of O children and excess of non-O children ($\chi^2 = 5.24$, 1 d.f., $P < 0.01$) born in compatible mating (Non-O mother and O father). While analysing the reciprocal parental mating types O mother and Non-O father (incompatible mating) significant excess of O children and deficit of non-O children ($\chi^2 = 4.16$, 1 d.f., $P < 0.05$) was noted. Moreover, deficiency of non-O (A/B/AB) children relative to O children in incompatible mating compared to those of compatible ones was significant ($\chi^2 = 9.44$, 1 d.f., $P < 0.01$).

Deficiencies of A and B children relative to O children in mating between O mother and non-O (A/B) father were compared with those children derived out of mating between non-O (A/B) mother and O father and were tested (Levine and Rosenfield 1961) for the analysis of segregation distortion by using cross ratio (r) and presented in Table 4. Examination on the deficiency ratio in the present study revealed a significant ($P < 0.05$) 46% deficiency of children in O mother and B father compared to the reciprocal combination of B father and O mother. On the other hand a moderately higher significant ($P < 0.05$) deficiency of 54% of children was found to the O mother and A father in comparison to A father and O mother. The obtained result of the present study was compared with those derived from a number of authors from India and abroad (Table-5). A significant deficiency of incompatible offspring was noted in the data of all authors excepting those of Johnston (1954) and Satyanarayan et al. (1978). A general deficiency of 24.70% incompatible offspring born to O mother was noted in European samples (Levine and Rosenfield, 1961). Compared to the above a higher amount of deficiency (41.20%) of offspring was found in Indian sample. Combining all those data obtained from studies of Indian authors significant deficiencies of A (42.40%) and B (35.80%) children born to O mother were found. The total deficiencies of A and B incompatible children among O mother was found to be 36% in Indian compared to 24.70% as reported by Levine and Rosenfield (1961). In the present study, however, the deficiencies of A (54 %) and B (46%) born to O mother and overall deficiency for A and B child (50%) were found to be fairly higher in

comparison to published Indian samples. This is might be due to the higher parity level compared to the single parity in other published Indian samples.

It will thus be apparent from the foregoing presentation that there exists definite evidence for distortion in segregation ratio of ABO blood groups among their children caused by deficiency of incompatible genotypes due to heterozygotic selection. Elimination of incompatible genotypes as expected brought significant difference ($\chi^2 = 10.25$, 3 d.f., $P < 0.05$) in the distribution of ABO blood groups between parents and children (Table 1). This was, however, due to decrease of A and B alleles and increase of O allele among the children compared to those among the parents.

Blood group substance could play an important role in the organisation of cell membrane structure and expression of membrane protein. Genetic polymorphism of blood groups might influence the function of proteins involved in substrate transport and signal transduction and thereby could effect intrauterine development and survival due to fetomaternal differences. ABO erythroblastosis is highly restricted in its distribution to the incompatible offspring of type O mother. As a health problem, ABO erythroblastosis does not represent a serious foetal loss from biological point of view. On the other hand, evidence of many kinds shows a much larger and biological important loss of possible incompatible children. For partial understanding of the loss of genotypes and thereby a distortion in segregation due to ABO incompatible mating pattern dynamics of the distributions of allele frequencies of ABO blood group in Bengalee population has been presented in Table 6. Distributions of allele frequency of ABO blood group over the decades revealed notable excess of O allele and deficiency of A allele, and increasing B allele frequency.

The phenomenon presently described could have an important role in the maintenance of ABO polymorphism in human population.

Table 1 : Distribution of ABO blood groups in the population

	Blood Group Phenotype				Allele Frequency			
	O	A	B	AB	TOTAL	A	B	O
Mother	241	190	312	73	816	0.1780	0.2740	0.5480
%	29.53	23.28	38.23	8.94				
Father	276	173	314	53	816	0.1510	0.2610	0.5880
%	33.82	21.20	38.48	6.49				
Parents	517	363	626	126	1632	0.1640	0.2740	0.580
%	31.67	22.24	38.35	7.72				
Children	393	226	441	58	1118	0.1374	0.2578	0.6046
%	35.15	20.21	39.44	5.18				

Table 2 : Segregation of ABO blood groups among the Children according to the compatible and incompatible mating types of parents.

Mating type compatible		N	Blood groups of the Children								Total No. of Children
Mother	Father		O	%	A	%	B	%	AB	%	
O	O	82	110	100	0	0	0	0	0	0	110
A	O	47	23	35.93	41	64.06	0	0	0	0	64
B	O	94	57	44.53	0	0	71	55.46	0	0	128
AB	O	18	0	0	12	46.16	14	53.84	0	0	26
A	A	56	7	9.58	66	90.41	0	0	0	0	73
B	B	144	24	12.63	0	0	166	87.36	0	0	190
AB	AB	6	0	0	1	14.28	1	14.28	5	71.42	7
AB	A	19	0	0	12	48.00	6	24.00	7	28.00	25
AB	B	10	0	0	3	21.42	5	35.71	6	42.85	14
Total		476	221	34.69	135	21.19	263	41.28	18	2.82	637
Mating type incompatible		N	Blood groups of the Children								Total No. of Children
Mother	Father		O	%	A	%	B	%	AB	%	
O	A	60	48	55.17	39	44.82	0	0	0	0	87
O	B	112	91	59.47	0	0	62	40.52	0	0	153
O	AB	22	0	0	12	34.28	23	65.71	0	0	35
B	A	55	15	18.75	11	13.28	23	65.52	0	0	80
A	B	46	18	26.86	16	23.88	21	31.34	12	17.91	67
A	AB	24	0	0	10	34.48	8	27.58	11	37.93	29
B	AB	21	0	0	3	10.00	24	80.00	3	10.00	30
Total		340	172	35.75	91	18.91	178	37.00	40	8.31	481

Table 3 : Segregation of O and Non O blood groups among children in reciprocal O and non-O mating types.

Mating type		No. of Mating	Children Blood Group of the children			
Mother	Father			O	Non-O (A/B)	Total
Non-O (A+B+AB)	O	159	Obs	80	138	218
			%	36.70	63.30	
			Exp.	96.8	121.2	
O	Non-O (A+B+AB)	194	Obs	139	136	275
			%	50.54	49.46	
			Exp.	122.2	152.8	
Total		353	Obs	219	274	493
			%	44.42	55.58	

Exp. = Expected

Table 4 : Segregation of children from ABO reciprocal mating : comparative study (Indian samples)

Mating Female-Male	No. of mating	Mean Parity	Children		Chi ² 1 d.f.	Source
			O	Non-O		
O - A	96	4.18	238 (59.0)	163 (41.0)	15.09*	Chakravartti & Chakravartti (1978)
A - O	103	4.50	214 (46.0)	250 (54.0)		
O - B	103	3.90	192 (48.0)	210 (52.0)	5.51*	
B - O	99	4.67	184 (40.0)	278 (60.0)		
O - A	11	2.73	15 (50.0)	15 (50.0)	0.40	Satyanarayan et.al, (1978)
A - O	20	2.80	21 (42.0)	29 (58.0)		
O - B	21	3.05	29 (45.0)	35 (55.0)	1.52	
B - O	23	3.48	28 (35.0)	52 (65.0)		
O - A	101	1.00	55 (54.0)	46 (46.0)	4.45*	Banerjee et. al, (1989)
A - O	99	1.00	39 (39.0)	60 (61.0)		
O - B	226	1.00	134 (49.0)	92 (51.0)	5.00*	
O - A	60	1.45	48 (55.18)	39 (44.82)	5.48*	Present Study
A - O	47	1.36	23 (35.93)	41 (64.07)		
O - B	112	1.36	91 (59.48)	62 (40.52)	6.24*	
B - O	94	1.36	57 (44.53)	71 (55.47)		

* (P < 0.05)

Table 5 : Deficiency of incompatible children born to a O mother compared with the number derived from reciprocal mating.

Number of mating (Male & Female)	No. of children	Deficiency %	Author
1. (O×A) Vs (A×O)	513	36*	Waterhouse and Hogben, 1947
2. (O×A)+(O×B) Vs (A×O)+(B×O)	1173	36*	Johnston 1954
3. (O×A) Vs (A×O)	1401	24*	Matsunaga, 1955
4. (O×B) Vs (B×O)	750	29*	Matsunaga, 1955
5. (O×A) Vs (A×O)	865	41*	Chakraborty, et. al, 1978
6. (O×B) Vs (B×O)	864	28	Chakraborty et. al, 1978
7. (O×A) Vs (A×O)	80	27	Satyanarayan et. al, 1978
8. (O×B) Vs (B×O)	144	35	Satyanarayan et. al, 1978
9. (O×A) Vs (A×O)	200	45*	Banerjee, 1989
10. (O×A) Vs (B×O)	430	35*	Banerjee, 1989
11. (O×A) Vs (A×O)	661	45*	Banerjee, 1996
12. (O×B) Vs (B×O)	1428	35*	Banerjee et. al. 1996
13. (O×B) Vs (B×O)	281	46*	Present study
14. (O×A) Vs (A×O)	151	54*	Present study

* (P < 0.05)

Table 6 : Dynamics of ABO blood group in Bengalee population

Author	N	Blood Group Phenotypes				Allelefrequency		
		O	A	B	AB	A	B	O
Majumder & Rao, 1958	1158*	362	288	392	109	0.1906	0.2489	0.5605
	%	31.45	25.02	34.06	9.47			
Chatterjee & Mukherjee, 1979	10044**	3194	2471	3585	794	0.1860	0.2550	0.5590
	%	31.80	24.60	35.70	7.90			
Banerjee & Chowdhury, 1988	8048	2640	1907	2840	6610	0.1752	0.2488	0.5760
	%	32.80	23.70	35.29	8.21			
Present study	2750	910	589	1067	184	0.1530	0.2626	0.5837
	%	33.03	21.41	38.80	6.69			

* Recalculated from Sen (1962)

** Pooled average from 85 samples

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Trace element analysis of human scalp hair — a viable model

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Abstract : A lot of emphasis is now being given to the broad field of trace element analysis of human scalp hair, though initial studies can be dated back to the 1960s. Studies include those on disease associations, forensic applications, understanding occupational and environmental exposure and nutritional status. However, there are a number of confounding factors that influence these trace element concentrations. These factors include age, sex, hair colour, effects of environment, effects of diet, effects of parental exposure, normal concentrations, pathological conditions and method of analysis. The present paper is an attempt to discuss these factors and to present a model where these factors are controlled to a great extent.

Key words : human hair, anthropology, applications, confounding factors

Introduction

Human scalp hair (HSH) has been a cornerstone of biological anthropology for decades. A lot of research has been undertaken using hair as a criterion for racial classification and on the genetic nature of hair morphological variables. Innumerable number of papers both from India and abroad have been published in this respect. This is probably one side of the research on HSH. The other side is analysing the concentration of trace elements in HSH.

Applications

It needs to be mentioned here that elemental hair analysis of HSH played an important role in various disciplines of biological and environmental sciences since the 1960s. The positive role played by HSH in documenting population exposure to different toxic elements has been strongly established (Seifert et al., 2000; Muckle et al., 2001). Elevated HSH concentrations of different toxic elements have been reported from urban/industrial areas over that of rural/agricultural areas (Sarami et al., 1994; Palheta and Taylor, 1995). It has also been pointed out that analysis of concentrations of essential elements such as zinc and copper in HSH is a quick and easy method to determine the nutritional status of a community. A number of researchers (Kvicala et al., 1995; Kaluza et al., 2001) have ascertained the nutritional status of a community by determining the concentrations of essential trace elements in HSH. In fact, the analysis of hair zinc concentration represents an addition to the conventional methods in the assessment of nutritional status. Studies have also indicated that poisoning of individuals by toxic elements can be determined by hair analysis (De Peyster and Silvers, 1995; Esteban et al., 1999). Studies have also been initiated on the relation between HSH trace element level and disease (Ilhan et al., 1999; Tang et al., 2003). Studies have also been undertaken on the relation of trace element concentrations and growth (Xue-Cum et al., 1985; Perrone et al., 1999).

The earliest study of trace element concentrations in HSH is that of Bate and Dyer

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(1965). Four years later Harrison et al. (1969) published their epic paper and formulated the main method of analysis. Since the 1970s a lot of research began to be initiated in this field. Indian studies did not lag behind as far as the initial study was concerned. The earliest Indian study was that of Gangadharan et al. (1972). But then came a period of stagnancy and studies in Indian only picked up in the late 1980s. However, Indian studies are far lesser in number when compared with those done abroad. Studies in India include those on disease associations (Srinivas et al., 2001), environmental exposure (Srivastava and Gupta, 1994), occupational exposure (Sukumar and Subramanian, 2000) and exposure to arsenic (Srivastava et al., 2001).

It was only in 1978 that research was done by an anthropologist in trace elements in HSH. This study (Benfer et al., 1978) analysed trace element concentrations in excavated human hair. Similar studies in this issue were then undertaken by Sandford et al. (1983) and Gonzalez-Reimers et al. (1991). In India, studies by biological anthropologists or anthropologists in the broad field of trace elements in HSH were non-existent till Sen and Das Chaudhuri (1995) pointed out the importance of trace element analysis in HSH in biological anthropology.

Confounding factors

There are many confounding factors influencing HSH trace element concentrations and hence, it is not feasible to compare the elemental values reported in various studies. The aim of the present paper is to understand the various issues faced by the researcher in determining trace element concentrations in HSH and to present a viable model for the same. The issues are briefly enumerated below :

1. Animal models : Animal models have numerous advantages over human studies, such as exclusion of external contaminants, exact control of the length of exposure and diet, and use of radioactive tracers. It has been pointed out the guinea pig to be the animal of choice for trace element analysis. This was primarily due to two factors, one being the elemental composition, and the other being the growth pattern of hair both of which closely resemble that of humans. However, as a result of the differences in metabolism and scatter of elemental values between species, the data obtained from such experiments cannot be directly applicable to humans.

2. Nutrition and Diet : The concentrations of essential elements in the body are greatly influenced by the diet. Moreover, hair zinc concentrations are related to physical growth. Positive correlation coefficients have been reported between hair zinc levels and height-for-age, weight and age in children (Xue-Cum et al., 1985). It has also been reported that zinc supplementation as analysed in hair zinc concentrations increases growth velocity (Castillo-Duran et al., 1994). Moreover, hair zinc and copper levels are also indicative of the nature of the diet of the community.

3. Hair Colour : Hair colour primarily depends on the size and density of the melanin pigments. Beside melanin, small air spaces and diameter of the hair shaft also contribute to hair colour. Variations in hair copper and zinc contents have been reported between red, black and white hair (Allegri et al., 1990). Hair lead concentrations were found to be decreased in order of red, blond, brown and black hair (Schuhmacher et al., 1991). It has

also been shown that blond hair is characterised by lower concentrations of zinc, copper and manganese, when compared to black, red and brown hair (Sturaro et al., 1994).

4. Pathological Condition : A number of researchers have shown that certain diseases/pathological conditions are associated with altered trace element concentrations in scalp hair. However, the utility of hair analysis in clinical medicine still remains obscure. Studies have sometimes reported great difference in HSH elemental concentrations between patients and control subjects. But variations in normal physiology and effects of age, sex and environment can easily vitiate such results. Hence, at present, HSH trace element analysis is more likely to be useful in experimental medicine rather than in clinical medicine.

5. Effects of the External Environment : This is a vital issue in trace elemental determination in HSH. Hair is an ion exchanger and hence is susceptible to contamination by external agents. It is still not possible to differentiate the exogenous and endogenous concentrations of trace elements in HSH. Moreover it has been pointed out that the inert structure of hair with its little porosity does not allow elements deposited on the hair surface to readily diffuse into the hair.

6. Age Variation : Studies have consistently reported variations in HSH trace element concentrations with age. Kozielc and Drybanska (1994) concluded that HSH lead levels were age-dependent. HSH copper concentrations were shown to decrease appreciably in females as age increased (Sturaro et al., 1994). Wilhelm et al., (1994) pointed out that children less than five years old have lower HSH zinc concentrations compared to older children. It was shown that hair zinc and lead concentrations were inversely related in various age groups (Meng, 1998).

7. Sex Variation : Sex variation is more marked than age variation in HSH trace element concentrations. In general, boys have higher elemental levels than girls. Wolfsperger et al. (1994) pointed out that arsenic and cadmium levels are higher in males than females. However, lower HSH lead and cadmium levels were observed in males than in females (Chlopicka et al., 1995; Vienna et al., 1995).

8. Parental Exposure : While studying occupational exposure, parental exposure in the workplace bears great importance. Children are observed to be affected by such exposures. Huel et al. (1984) reported higher HSH cadmium levels among newborns with maternal cadmium exposure. Wilhelm et al. (1994) reported elevated lead levels in the scalp hair of children whose parents were occupationally exposed to lead.

9. Ethnic Group : The genetic background and ethnic distribution of HSH trace element concentrations remain obscure. Studies on human populations involving blood groups, serum proteins, dermatoglyphics and anthropometry have strongly indicated their genetic background and ethnic variations. A computer-generated literature search on these issues involving HSH trace elements yielded just two studies during the last ten years. One study (Batzevich, 1995) showed that ethnic differentiations in HSH trace element distribution are next to impossible as these concentrations are highly influenced by nutritional and environmental factors. The other (Pavlov and Alisieich, 1999) showed that HSH trace element concentrations differ significantly between people from various countries. However, this dearth of information on the genetic background and ethnic differentiations of HSH trace element concentrations should not be interpreted as having no effects on the same.

The picture will remain obscure until and unless more rigorously controlled studies are initiated.

10. Normal Concentrations : The concept of "normal" concentrations of HSH trace elements leaves a lot to be desired. The classification of "normal" individuals depends on the model the researcher is using. For studies involving diseases, it refers to healthy individuals. Studies probing the environmental implications refer to "normal" individuals as those residing in the rural areas. Again, for studies on different occupational groups, "normal" individuals are those unexposed to the elements under study in the workplace. hence, "normal" concentrations for elements in hair is strongly dependent on the absence of certain factors like diet imbalances, pathological conditions and exposure to toxicants. There is also a dearth of "reference values" for various elements in HSH. However, several institutions like the International Atomic Energy Agency, Austria and the National Institute of Environmental Studies, Japan have extensive programs for the determination of "reference values" for trace elements in human hair.

11. Washing Methods : Presently, a number of washing methods is being used to wash HSH hair samples. Any form of washing alters the trace element concentrations in the sample. This alteration depends on the chemicals being used, be it a non-ionic detergent or an organic solvent. So, unless a widely accepted method is used, it is not wise to compare the results of studies that use different washing procedures.

The model

The above-mentioned issues are some of the main disadvantages faced by the researcher while determining trace element concentration in HSH. Designing an experimental model so as to control all these variables is a formidable task. Innumerable studies exist in the relationship of trace elements in HSH with certain diseases or pathological conditions. In all these studies, "control" samples were collected from individuals who were healthy. Similarly, studies on the environmental aspect referred to individuals residing in rural areas as 'control' samples. Studies associated with the occupational aspect identified individuals occupationally unexposed to the elements under study as 'controls'. All these "control" samples in fact represent a misnomer. Trace element concentrations in HSH are strongly influenced by a number of factors. These factors have been just discussed above. So in most of the studies on trace element concentrations in HSH, unless these factors are controlled it is not possible or feasible to really correlate the levels of trace elements in HSH with a specific disease or environmental exposure or occupational exposure.

Primarily, the researcher should sample complete healthy individuals (both exposed and control) belonging to the same socio-economic group. The socio-economic group can be identified by family income/expenditure and family size. This will largely control the effects due to nutrition and diet. All the individuals should belong to a narrow age group and be limited to one sex only. These will curtail the effects of age and sex. Individuals having the same hair colour should be sampled. Those adhering to hair dyes and bleaches, and those using hair oils, lacquer and shampoos, at least three days prior to sampling, should be rejected. Hence, the effects of hair colour will be greatly controlled. Furthermore, hair dyes, bleaches, oils, lacquers and shampoos themselves alter the levels of trace elements

in the hair. Though at present, the roles of genetic and ethnic factors in HSH trace element concentrations remain unclear, the best solution would be to sample individuals belonging to the same ethnic group. Moreover, the parents should be occupationally unexposed and an universally accepted washing method should be used. Only after controlling these above factors, the researcher should venture into the study- specific 'controls' like healthy individuals for disease and rural populations for environmental studies.

The present author has initiated a study on HSH trace element concentrations probing the environmental and occupational exposures to copper and lead. This is in all probability the first study of its kind by a biological anthropologist in India. The sampling model envisages sampling only male individuals from the same socio-economic group having an average annual income of not more than Rs. 24,000/=, a family size of not more than 6 members and belonging to the age group of 25-30 years from three areas. All the individuals were from the Bengalee Hindu Caste Population (BHCP). During sampling, care was taken to note that none of the individuals used hair treatments, and none used shampoos at least three days prior to sampling. The HSH samples were washed, dried and acid digested. The concentrations of different elements were determined by flame atomic absorption spectrophotometry.

The method of washing and analysis have already been published (Sen and Das Chaudhuri, 2001). Moreover, the "base-line" values for copper, zinc, lead, nickel and magnesium for the BHCP have already been reported (Sen and Das Chaudhuri, 1996). It may be mentioned here that the "base-line" values were obtained from individuals engaged in agriculture and residing in a rural area. This "base-line" study was probably the first of its kind for the BHCP. The present authors have also utilised HSH to document environmental exposure to lead among three occupationally unexposed populations groups in Calcutta (Sen and Chaudhuri, 1996).

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Nutritional status and level of subcutaneous fatness among the Bengalee boys 7-16 years: Secular trends over two decades

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Abstract : Nutritional status and level of subcutaneous fatness of the school aged and adolescent Bengalee boys of Kolkata city have been assessed to evaluate the changes taking place in the two decades. Data comes from two cross-sectional surveys carried out in 1982-83 and 1999-01 among the middle class Bengalee boys aged 7.0-16.0 years (n = 816) in the same area of the city following the similar methods of sampling and measurements.

Age specific nutritional status, calculated following the WHO classification (1995), shows that overall prevalence of stunting declined from 11.2% in 1982-83 to 6.0% in 1999-01, thinning from 50.5% to 31.5%. While prevalence of overweight remained unchanged, obesity has just emerged (1.6%). Age specific mean BMI shows significantly higher values the later survey particularly during the years of adolescence. Similarly triceps and subscapular skinfolds show higher means in 1999-01 survey, which are statistically significant at most ages.

All these changes are consistent in 1999-01 survey and therefore may be interpreted as an indicator of positive secular shift that may have resulted due to changes in the components of socio-economic factors viz., mother's education and level of per capita family expenditure.

Running Title : Secular trends in nutritional status and subcutaneous fatness level.

Key words : School aged and adolescents, Bengalee boys, secular trends, nutritional status, subcutaneous fatness, socio-economic factors.

Introduction

The occurrence of secular trends is mostly evaluated on the measures of body size and in the rate of maturation of children (Eveleth and Tanner, 1990, Bodzsar and Susanne, 1998). However, similar investigations related to changes in the measures of nutritional status and body fatness are of recent research interest (Norgan, 1995, Thompson et al., 2002). Of late, such studies have been carried out in China (Wang et al., 1998), Brazil (Monteiro et al., 1994), Chile (Dittmar, 1998), Thailand (Sungthong et al., 1999) and other developing countries. It may be noted that one of the primary objectives of undertaking these studies is to measure the impact of the reforms through which these countries are now passing due to the acceptance of the new economic policy (Popkin, 1994, Shen et al., 1998).

The periods of school age and adolescence are generally considered to be of prime importance for studying the secular trends as these periods are vulnerable to major social and economic changes in the population in comparison to other periods of life (WHO, 1995, Stinson, 2000). Adolescents, according to WHO (1986) are persons aged 10 -19 years who constitute about 19% of the total world population. Adolescents faces a series of serious

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nutritional changes not only affecting their growth and development but also their livelihood as adults (Kurz, 1996). Yet they remain a largely neglected group (WHO, 2002). The school-aged children have also suffered similar neglect. It has become evident that high level of nutritional deprivation combined with the heavy burden of disease during the school age period has harmful influences for a child's long term overall development. This has prompted an increased focus on the diverse needs of the school aged child as well (Drake et al., 2002).

The Government of India initiated major economic reforms in 1991 (Thankappan, 2001). After nearly a decade has elapsed since its imposition, hardly any attempt has been made to study secular changes in physical growth and rate of maturation of Indian children. Further, no investigation has so far been carried out to examine the occurrence of secular changes in nutritional status and body fatness level of the children in particular. The present paper deals with the evaluation of two-decade changes in age specific nutritional status and subcutaneous fatness level of the urban Bengalee School aged and adolescent boys of Kolkata City aged 7-16 years.

Materials and Methods

The data sets come from two cross-sectional surveys, one conducted during 1982-83 (the baseline survey) and the other, during 1999-2001 (the ongoing survey). All participants the two surveys were Bengalee school aged and adolescent boys, aged 7 -16 years, sampled from the Scottish Church Collegiate School, Kolkata. In both surveys, the subjects voluntarily participated in response to the appeal made by the school and the Institute authorities to their guardians. The ongoing survey is of longer duration and with larger sample than the baseline. Comparison of the data sets analysed from the two surveys will be de in the present communication.

The Scottish Church Collegiate School was established in 1830 by a Scottish Missionary with a total strength of about 3000 students from classes I to X. The school is a Bengalee medium and the students compare well with those Bengalee boys nourished in the middle class Bengalee families in the city of Kolkata. Since a secular trend study was planned to be carried out, therefore according to the given recommendations, the region, sampling technique, measurement protocol were retained identical in both the studies (Cernerud and Lindgren, 1991, Zellner et al., 1996, Hoppa and Garlie, 1998). As in the baseline survey the sample covered was 816 boys, therefore in the second ongoing survey, anthropometric data of 816 boys were randomly selected from 1200 subjects measured so far and their age wise distribution (in both surveys) are given in table 1. The socio-economic and demographic characters of the families are presented in the table 2.

Anthropometric Data : Anthropometric measurements in both surveys were taken in accordance with the protocol of the International Biological Program, 1969 (Weiner and Lourie, 1969). The subjects were measured on their verified birth dates with a relaxation of ± 3 days. Height was recorded to 0.1 cm by using the GPM anthropometric set. The boys were weighed using the lever-actuated balance to the nearest 0.5 kilograms wearing light pants only. From these measurements we calculated Body Mass Index ($BMI = wt/ht^2$ in kg/m^2) of all the subjects of the two surveys. Two skinfolds, namely triceps and

subscapular, were measured on the left side of the body nearest to 0.5 mm by using Lange skinfold caliper. The measurements of 1982-83 survey and 1999-2001 survey were taken by the third (PDG) and the first author (RS) respectively trained by the third author (PDG). In the ongoing survey, the measurements were taken from 8:00 am to 2:00 pm within the school premises and in the households of the school boys with the help of a field assistant while in the previous survey measurements were performed only in the school premises.

The precision of the measurements (intra observer) was assessed by calculating the technical error of measurements (TEM) (Ulijaszek and Kerr, 1999). The calculated TEM values of stature, weight, triceps and subscapular skinfolds are 0.155 cm, 0.156 kg, 0.788 mm and 0.822 mm respectively, which are well below the maximum acceptable reference values reported (Frisancho, 1990, Ulijaszek and Lourie, 1994).

Socio-economic and demographic data : In both surveys, the socio-economic and demographic data of the schoolboys were collected by identical ways: firstly, by canvassing questionnaire schedules to the students and secondly by paying house visits conducted by the third author (PDG) in 1982-83 and by first author (RS) in 1999-01 with the help of the field assistants. Socio-economic and demographic data were collected with respect to parental education and occupation, per capita monthly family expenditure, parity and sibship size of the students. The comparison of the socio-economic and demographic characteristics during the two time points is presented in the table 2.

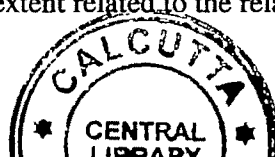
Analysis of data : The National Centre for Health Statistics (NCHS) reference data for height-for-age, BMI-for-age, triceps skinfold-for-age and subscapular skinfolds-for age were used to estimate the age specific prevalence of stunting, thinning, overweight and obesity according to the recommendations made by the World Health Organization Expert Committee (World Health Organisation, 1995). Stunting has been assessed by height for age less than 3rd percentile or $-2z$ score. Thinning and Overweight have been assessed from BMI for age less than 5th percentile and ≥ 85 th percentiles respectively. Obesity has been assessed as BMI ≥ 85 th percentile and triceps and subscapular skinfolds ≥ 90 th percentile.

Analysis of the data on BMI was limited to the children aged 9.0 to 16.0 years according to the recommendations (WHO, 1995). Significance of the differences in the prevalence rate in stunting, thinning, overweight and obesity between the two surveys was tested by χ^2 test. Age specific means and standard deviations of BMI, triceps and subscapular skinfold thicknesses of the two surveys were compared by unpaired students' t-test. Since the distributions of the skinfolds were positively skewed (Marshall, 1977), therefore unpaired students t-test was performed on the log transformed (log 10) values.

Results

Secular trends in nutritional Status : Nutritional status of the boys aged, 7-16 years, assessed in the two surveys by the prevalence of stunting, thinning, overweight and obesity and are presented in the tables 3- 5 and figures 1-4 respectively.

Stunting : The overall prevalence of stunting in relation to the recommended cut-offs are 11.2% and 9.4% respectively in 1982-83 and 6.0% and 4.6% respectively in 1999-2001 (table 3 and figures 1-2). The fluctuation of the prevalence across age groups by using the different cut-off criteria was probably to some extent related to the relatively small sample



size (de Onis et al., 2001). It may be noted that the prevalence of stunting declined in 1999-2001 compared to 1982-83. This decline in the overall prevalence rate is found to be statistically significant at 5% level as revealed from the χ^2 values. The prevalence of stunting at all ages from 7.0 to 14.0 years' show a consistent decline in the second survey compared to the baseline survey. In older ages i.e. 15.0 and 16.0 years, the trend is not clear. Although age specific differences of stunting are statistically insignificant, but the overall decline is statistically significant.

Thinning: The prevalence of thinning however shows a different picture. As shown in table 4 figure 3, its prevalence at all ages from 9.0 to 16.0 years show a decline in the ongoing survey compared to the baseline survey. These declines are insignificant in five age classes while significant at ages 11.0, 12.0 and 14.0 years. But it is interesting to note that the overall decline of thinning from 50.5% in 1982-83 to 31.5% in 1999-2001 is much greater in magnitude (19%) than stunting (5.2%) and are statistically significant at 1% and 5% level respectively.

Overweight : The prevalence of overweight shows decrease at all ages except, at 9 years. However, the overall prevalence rate remained unchanged between 1982-83 and 1999-2001 study as revealed from table 5 & figure 4. The age specific changes are all statistically insignificant.

Obesity : The prevalence of obesity is found to have emerged only in the ongoing survey, which did not occur in the 1982-83 study. In the 1999-2001 study it occurred in the sample and varies over the ages from 2.2% to 7.7% with average of 1.6%.

Secular trends in fatness level :

Body Mass Index: Age specific means and standard deviations of body mass index for the baseline study and the present study are presented in the table 6 and figure 5. It is observed that in the second study mean BMI has increased at all ages. Such increase is particularly marked during certain years of adolescence, i.e., 11.0 year (1.29kg/m²) followed by 12.0 year (1.29kg/m²) and 13.0 year (1.0kg/m²). It is also important to note that in eight age class (except in 15.0 and 16.0 years) the increase in BMI means are statistically significant at $p < 0.05$ level.

Triceps skinfold thickness : Age specific means and standard deviations of triceps skinfolds are shown in table 7 and figure 6. For all ages it shows an increase in the mean values in comparison to the baseline study (Pakrasi et al., 1988). The result shows statistically significant increase particularly at ages 7.0, 8.0, 9.0, 11.0, 12.0 and 14.0 years.

Subscapular Skinfold Thickness : Age specific means and standard deviations of subscapular skinfolds are presented in table 8 and figure 7. It is observed that for all ages there is an increase in the means of subscapular skinfolds in the second study compared to the baseline study. In eight ages (except 15.0 and 16.0 years) the differences are statistically significant.

Discussion

1. Secular trends of Nutritional Status in Developing countries

(a) **Stunting :** Our results are similar to a recent study in China, which shows that in adolescents aged 10 to 18 years stunting declined by 4% (from 23% to 19%) in the

intervals of only two years (1991-1993) (Wang et al., 1998) though the duration of the studies differ. But in the coastal children of Papua New Guinea, such decline is 6% in 15 years (43% to 37% from 1969-1984) (Norgan, 1995). On the contrary, during the same time period, among the highland children of Papua New Guinea, stunting rose by 3% (50% to 53%). Our findings have also indicated a decline in the rate of stunting over the past two decades, which is notable. A decreasing rate of stunting is usually indicative of improvements in overall socioeconomic condition of a country (Frongillo et al., 1997)

(b) Thinning : Though our results have shown a marked decline in the prevalence of thinness by 19% in about two decades (1982-1999), in China within two years of interval (1991-1993), the rate of thinning has decreased by only 1% (13% to 12%) (Wang et al., 1998).

(c) Overweight and Obesity : Perhaps due to smallness of the sample size our results do not show any appreciable changes in the prevalence of overweight, though in some cases its increase has been observed. In China, among urban boys, prevalence of overweight indicates an increase from 9% to 10% between 1991 and 1993. Increase in dietary fat intake and lower level of physical activity has been attributed to such change (Moreno et al., 2001). A longitudinal study of 2,252 primary and secondary school children in Hat Yai urban area of Thailand found that overweight in males increased from 12.4% in 1992 to 21% in 1997 (Mo Suwan et al., 1993).

2. Secular trends of Fatness Level in the developing countries

(a) Body Mass Index Trends : To our knowledge, no studies are available on secular trend in Body Mass Index from any Indian populations. Among the recently studied countries undergoing transition like China, mean increase of 0.2 kg/m² in 2 years (from 21.2—21.4 kg/m²) in BMI level of adolescents has been reported (Wang et al., 1998). Among the Kaul and Lufa children of Papua New Guinea aged 10-19 years mean BMI decreased by 0.3 kg/m² and increased by 0.1 kg/m² between 1969 and 1984 (15 years) respectively. In the present study maximum increase of mean BMI (1.29 kg/m²) has been observed in 14.0 year.

(b) Skinfold thickness Level : As in our study increasing changes are reported only from two developing countries. In Peru, the subjects measured in 1983-84 for the five skinfold sites (including triceps and subscapular skinfolds) show that they have become fatter compared to those measured in twenty years ago (1963-64) (Leatherman et al., 1995). Among the rural communities in Papua New Guinea, mean triceps skinfolds were significantly higher in all age groups in 1984 in comparison to 1969. In the present study, maximum mean increase of 1.8 mm at triceps skinfolds is found at age 11 years. In England and Scotland, for the period lasting from 1972 to 1994 mean increments in BMI are paralleled by an increase in mean triceps skinfolds thickness in most age groups between 1972 to 1994 (Chinn et al., 1998). Such a trend therefore resembles well with the findings of our study.

3. Secular trends in nutritional status and fatness level in the developed countries.

While secular trends in prevalence of stunting and thinning have been investigated to a greater extent in the developing countries, on the other hand, similar studies with respect to overweight and obesity are mostly investigated in the developed countries. Recent reports

available from USA (Troiano et al., 1995), Germany (Kromeyer Hauschild et al., 1999), and Spain (Moreno et al., 2001), show that over the last one to three decades overweight has increased about 6-7% while obesity from 1 to 3% for these age groups. With respect to BMI secular investigations for these age groups were carried out in Britain (China et al., 1998), Canada (Tremblay and Willims, 2000), Spain (Moreno et al., 2001), Greece (Krassas et al., 2001), Finland (Kantainen et al., 2002). The duration of these investigation ranged from 1-5 decades and the increase varies from 0.15 kg/m² to 2.0 kg/m². However, in our sample the rise in BMI is not so alarming.

4. Comparison of prevalence of nutritional status with other studies from India and the developing countries

(a) Stunting and thinning : Results of our baseline survey (de Onis et al., 2001) as well as the present survey in Calcutta are consistently showing greater prevalence of thinning than stunting. This is confirmed from a recent review which shows that out of the eight surveys available, five have shown greater prevalence of thinning than stunting (Woodruff and Duffield, 2002). Among the adolescents of Bangladesh (Shahabuddin et al., 2000) while the prevalence of stunting (67%) is considerably higher than our results, thinning (48%) is close to our findings. In addition, the authors also reported age variation in the prevalence rates. The Partnership for Child Development (1998) reports the prevalence of stunting and underweight of rural school from several third world countries Ghana, Tanzania, Indonesia, Vietnam and India which varies from 48% to 56% for stunting, and 34% to 62% for underweight. In comparison to these findings, prevalence of stunting and thinning obtained from the present study reflects better situation of nutritional status of the Bengalee boys of Calcutta. While comparing with other Indian population it becomes evident that among the rural adolescents of North India (Anand et al., 1999), the prevalence of stunting of the Calcutta boys are found to be considerably lower. But the age specific prevalence for thinning, two studies resemble in most of the ages. However, with respect to the prevalence of thinning, the other Indian study carried out in Bombay has reported it to be 35 %, which is higher than our value (30%). (Table 9).

(b) Overweight and obesity: The prevalence of overweight in the present study only (4.7%) is not so alarming in comparison to other developing countries like UAE (16.5%, Al-Haddad et al., 2000) and Seychelles (9.2%, Steller et al., 2002), which are now undergoing transition. The overall prevalence of obesity is only 1.6% in the later survey, whereas in the baseline survey it did not occur. The figure may be compared with other developed and developing countries. The Kuwaties shows 20.6% and 15.4% increase in the level of overweight and obesity respectively in 13 years interval (1981-1994) (Al-Isa, 1997). In Brazil, obesity has increased 2.3% in 14 years (1975-1989) and 2.2% within 8 years (1989-1997) (Monteiro et al., 2000). In Chile 20.7% of the school children were reported to be overweight and 13.5% obese in 1995 (Kain et al., 1998). However the findings from the present study are not so appalling.

A study of school aged children (and preschool age) in four countries undergoing nutrition transition (Russia, China, Brazil and South Africa) found that the prevalence of

child overweight ranged from 10.55 to 25.6% (Weight for height at or above the 85th percentile). Boys in Russia have an overweight prevalence comparable with boys in the US (11.8% > 95th percentile) (Popkin et. al., 1996). Uauy and Kain, (2002) have observed a drop-in stunting associated with rise in obesity trends as evident in Chile.

In comparison to a recent Indian study carried out on the affluent communities of Delhi (Kapil et. al., 2002) the prevalence of overweight and obesity of the Calcutta boys are found to be considerably lower over the comparing ages (table 9). Interestingly the age specific mean BMI values of the Calcutta boys show close proximity with the values provided by Agarwal et al., (2001) from North India (Table 9).

Conclusion : Recently Woodruff and Duffield (2002) have criticised the use of WHO cut off for assessing the nutritional status of the adolescent population. According to the authors, the given cut off overestimated the prevalence of thinning in our baseline survey (de Onis et at., 2001). In addition, for the assessment of overweight and obesity the authors recommended Cole's reference (Cole et al., 2000) though several authors have questioned about its applicability (Hesketh and Ding, 2000, Wang and Wang, 2000). But since a secular trend study was planned to be carried out, we had to use the similar cut off in the later survey (ongoing) to assess the trends. ACC/SCN (1997) has emphasized that there should be consistency in the presentation and reporting of stunting data for comparisons as well as for reporting changes over time. Several researchers have suggested to introduce the local cut off and future studies should be aimed at this direction.

Overall decline in the prevalence of stunting and thinning can be interpreted by improved socioeconomic situation of the families of the schoolboys in comparison to the previous survey. Table no. 2 shows the improved mothers level of education which are generally found to effect the growth status of the children. In addition, per capita levels of expenditure of the families are observed to be high in the later survey when adjusted with the expenditure level of the previous survey. Among the demographic variables, family size and sib-size are also found to have decreased in the ongoing survey, which are generally related with improved socioeconomic condition.

Increasing trends of the subcutaneous fatness level of the European children has been associated with changes in the feeding pattern, food habits and physical activity pattern (Kromeyer Hauschild et al., 1999). Unfortunately accessibility to similar data sets were not possible. However, the National Sample Survey Organisation of Government of India, records data on the dietary consumption of urban people over time. Since the study is ongoing, we have to investigate on this aspect at the end of the survey. Similarly though emergence of overweight and obesity are not so alarming in our study, but have been stated to occur when the dietary energy consumption exceeds metabolic expenditure (Moreno et al., 2001). Data sets on these aspects for the two study periods are not available with us.

This small scale study although has shown some trends for the boys, but similar investigations on trends for the girls for these age periods still remain unexplored. Future studies should aim in this direction which would reveal gender differences in the secular phenomena in nutritional status and level of fatness.

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Table 1 : Age distribution of the sample (in baseline and ongoing surveys)

Age (years)	No. Of individuals
7.0	63
8.0	87
9.0	96
10.0	75
11.0	97
12.0	96
13.0	98
14.0	93
15.0	75
16.0	36
Total	816

Table 2 : Socio-economic and demographic characteristics of sample in the 1982-83 and 1999-2001 survey.

Socio-economic and demorgaphic variables	1982-83	1999-2001
Father's education		
i) Below matriculate	18.25%	5.77%
ii) Matriculate to below graduate	44.87%	31.66%
iii) Graduate and above	36.88%	62.57%
Father's occupation		
i) Professional, managerial and administrative	24.13%	57.76%
ii) Clerical and sales	29.58%	40.86%
iii) Manual workers	46.29%	1.38%
Mother's education		
i) Below matriculate	36.27%	12.34%
ii) Matriculate to below graduate	44.12%	45.13%
iii) Graduate and above	19.61%	42.53%
Mother's occupation		
i) Professional, managerial and administrative	2.50%	5.76%
ii) Clerical and sales	1.00%	1.65%
iii) Manual workers	1.50%	0.18%
iv) House wife	95.00%	92.41%
Per capita monthly expenditure	Rs. 30/- to	Rs. 250/- to
Order of birth of the subjects	Rs. 1000/-	Rs. 2500/-
i) 1	54.00%	70.45%
ii) 1+	46.00%	29.55%
Sibship size		
i) No sibs	23.29%	44.51%
ii) One sib	46.82%	45.95%
iii) More than one sib	29.89%	9.54%

Table 3 : Secular trends in the prevalence of stunting between two study periods (1982-83 and 1999-2001).

Age (years)	< 3rd percentile Of stature for age		Decline In prevalence rate (%)	< -2z score Of stature for age		Decline In prevalence rate
	1982-83	1999-2001		1982-83	1999-2001	
	%	%		%	%	
7.0	14.3	6.7	7.9	12.7	4.8	7.9
8.0	5.7	2.3	3.4	5.7	2.3	3.4
9.0	9.4	5.2	4.2	7.3	3.1	4.2
10.0	8.0	4.0	4.0	6.6	1.3	5.3
11.0	11.3	9.3	2.0	10.3	8.3	2.0
12.0	21.9	8.3	13.6	18.8	6.3	12.5
13.0	7.1	3.1	4.0	7.1	2.0	5.1
14.0	14.0	3.2	10.8	10.8	3.2	7.6
15.0	6.7	6.7	—	4.0	4.0	—
16.0	13.9	11.1	2.8	11.1	11.1	—
All ages	11.2	6.0	5.2*	9.4	4.6	4.8*

* 5% level of significance

Table 4 : Secular trends in the prevalence of thinning between two study periods (1982-83 and 1999-2001).

Age (years)	< 5th percentile Of BMI for age		Decline In prevalence rate
	1982-83	1999-2001	
	%	%	
9.0	43.0	21.5	21.5
10.0	50.0	29.7	20.3
11.0	50.0	24.0	26.0*
12.0	56.4	25.5	30.9*
13.0	50.0	39.8	10.2
14.0	58.1	29.0	29.1*
15.0	45.9	40.5	5.4
16.0	47.2	41.7	5.5
All ages	50.5	31.5	19.0**

* 5% level of significance ** 1% level of significance

Table 5 : Secular trends in the prevalence of overweight between two study periods (1982-83 and 1999-2001).

Age (years)	< 85th percentile Of BMI for age		Decline In prevalence rate
	1982-83	1999-2001	
	%	%	%
9.0	7.5	15.5	8.0
10.0	10.8	9.5	-1.3
11.0	7.3	6.3	-1.0
12.0	5.3	2.1	-3.2
13.0	—	—	—
14.0	1.1	1.1	—
15.0	2.7	—	2.7
16.0	2.8	2.8	—
All ages	4.7	4.7	—

Table 6 : Secular trends in mean Body Mass Index (kg/m²) between two study periods 1982-83 to 1999-2001.

Age (in years)	N	1982-83	1999-2001	Increase in mean BMI
		Mean $\pm$ SD	Mean $\pm$ SD	
7.0	63	13.9 $\pm$ 2.2	15.5 $\pm$ 2.3	1.6*
8.0	87	14.2 $\pm$ 2.9	15.4 $\pm$ 2.1	1.2*
9.0	93	14.9 $\pm$ 2.5	15.8 $\pm$ 2.3	0.9*
10.0	74	15.2 $\pm$ 2.6	16.0 $\pm$ 2.4	0.8*
11.0	96	15.4 $\pm$ 3.0	16.7 $\pm$ 2.4	1.3*
12.0	94	15.5 $\pm$ 2.5	16.7 $\pm$ 2.2	1.2*
13.0	98	15.8 $\pm$ 1.9	16.8 $\pm$ 1.8	1.0*
14.0	93	16.3 $\pm$ 2.2	17.3 $\pm$ 2.1	1.0*
15.0	74	17.3 $\pm$ 2.7	17.5 $\pm$ 2.2	0.2
16.0	36	17.8 $\pm$ 3.0	17.8 $\pm$ 2.2	—

* 5% level of significance

Table 7 : Secular trends in mean triceps skinfold thickness (mm) between the study periods 1982-83 to 1999-2001.

Age (in years)	N	1982-83	1999-2001	Increase in mean triceps
		Mean $\pm$ SD	Mean $\pm$ SD	
7.0	62	7.5 $\pm$ 3.0	8.9 $\pm$ 2.8	1.4*
8.0	82	8.2 $\pm$ 4.0	9.7 $\pm$ 3.5	1.5*
9.0	91	8.4 $\pm$ 3.5	10.0 $\pm$ 3.6	1.6*
10.0	76	10.1 $\pm$ 5.4	10.9 $\pm$ 3.6	0.8*
11.0	97	10.2 $\pm$ 5.4	12.0 $\pm$ 4.1	1.8*
12.0	95	9.3 $\pm$ 4.2	11.0 $\pm$ 3.7	1.7*
13.0	95	9.3 $\pm$ 3.8	9.3 $\pm$ 2.6	—
14.0	93	8.8 $\pm$ 4.1	9.5 $\pm$ 3.0	0.7*
15.0	76	9.3 $\pm$ 4.4	9.5 $\pm$ 3.5	0.2
16.0	36	9.0 $\pm$ 4.0	9.1 $\pm$ 3.6	0.1

* 5% level of significance

Table 8 : Secular trends in mean subscapular skinfold thickness (mm) between the study periods 1982-83 to 1999-2001.

Age (in years)	N	1982-83	1999-2001	Increase in mean subscapular
		Mean $\pm$ SD	Mean $\pm$ SD	
7.0	62	5.8 $\pm$ 2.2	7.0 $\pm$ 3.0	1.2*
8.0	83	6.4 $\pm$ 3.7	7.8 $\pm$ 3.8	1.4*
9.0	92	6.5 $\pm$ 3.2	8.0 $\pm$ 3.3	1.5*
10.0	72	7.2 $\pm$ 3.7	9.0 $\pm$ 4.0	1.8*
11.0	92	7.8 $\pm$ 3.9	10.3 $\pm$ 4.1	2.5*
12.0	90	7.8 $\pm$ 4.3	9.2 $\pm$ 3.8	1.4*
13.0	91	7.1 $\pm$ 2.4	8.2 $\pm$ 2.7	1.1*
14.0	92	7.9 $\pm$ 4.1	8.6 $\pm$ 2.7	0.7*
15.0	73	8.6 $\pm$ 3.6	9.0 $\pm$ 3.3	0.4
16.0	35	9.2 $\pm$ 3.8	9.8 $\pm$ 3.7	0.6

* 5% level of significance

Table 9 : Nutritional status and body mass index of the school aged boys and adolescents of Calcutta-prevalence comparison with other Indian Studies.

i) Nutritional status

a) Stunting and thinning

Age	Prevalence of stunting (%)		Prevalence of thinning (%)	
	This study	Anand et al., 1999	This study	Annand et al., 1999
12.0	8.3 (96)	33.3 (36)		
13.0	3.1 (98)	28.0 (50)	39.8 (98)	50.5 (50)
14.0	3.2 (93)	16.7 (36)	29.0 (93)	36.0 (36)
15.0	6.7 (75)	14.5 (62)	40.5 (75)	41.7 (62)
16.0	11.1 (36)	13.7 (73)	41.7 (36)	43.5 (73)

(Number of children are indicated in the parenthesis)

b) Overweight and obesity

Age	Prevalence of overweight (%)		Prevalence of obesity (%)	
	This study	Kapil et al., 2002	This study	Kapil et al., 2002
10.0	9.5 (75)	40.0 (35)	2.8 (75)	17.1 (35)
11.0	6.3 (96)	20.7 (82)	2.2 (97)	12.2 (82)
12.0	2.1 (96)	27.8 (108)	—	7.4 (108)
13.0	—	20.0 (95)	—	7.4 (95)
14.0	1.1 (93)	26.8 (97)	—	5.2 (97)
15.0	—	16.8 (89)	—	9.0 (89)
16.0	2.8 (36)	15.8 (57)	—	5.3 (57)

(Number of children are indicated in the parenthesis)

ii) Body Mass Index

Age	Prevalence of stunting (%)	
	This study	Agarwal et al., 2001
7.0	15.5 (63)	15.0 (501)
8.0	15.4 (87)	15.2 (585)
9.0	15.8 (93)	15.6 (701)
10.0	16.0 (74)	16.1 (1135)
11.0	16.7 (96)	16.6 (1476)
12.0	16.7 (94)	17.1 (1652)
13.0	16.8 (98)	17.7 (1591)
14.0	17.3 (93)	18.2 (1433)
15.0	17.5 (74)	19.2 (1093)
16.0	17.8 (36)	19.7 (771)

(Number of children are indicated in the parenthesis)

Table 10 : Secular trends in prevalence of stunting, thinning and overweight observed in the present study in comparison to some recently studied populations of the developing world.

Country	Author	Age	Study Period	Duration	Increase/Decrease of		
					Stunting	Thinning	Overweight
China	Wang et al., 1998	10-18 years	1991-1993	2 years	-4%	-1%	+1%
China	Popkin et al., 1996	7-18 years	1991-1993	2 years			
Thailand	Mo Suwan et al, 1993	6-12 years	1992-1997	5 years			
Papua New Guinea	Norgan, 1995	2-10 years	1969-1984	15 years	-6%		+8.6%
i) coastal ii) highland					+3%		
Chile	Kain et al., 2002	6-years	1987-1996	9 years	-5%		
This study	Saha et al., 2003	7-16 years	1982-1983 1999-2001	17 years	-5.2% -4.8%	-19.0%	—

Table 11 : Secular trends in Body Mass index and triceps skinfolds in the present study in comparison to populations of the developing countries.

Country	Author	Age	Study Period	Duration	Increase of		
					BMI	Triceps	Subscapular
China	Wang et al., 1998	10-18 years	1991-1993	2 years	0.2kg/m ²		
Papua New Guinea	Norgan, 1995	10-19 years	1969-1984	15 years	-0.3kg/m ² 0.1kg/m ²	0.4mm 0.7mm	0.2mm
This study	Saha et al., 2003	7-16 years	1982-1983 1999-2001	17 years	0.92kg/m ²	0.98mm	1.26mm

Figure 1 : Secular trends in the prevalence of stunting as determined by < 3rd percentile of stature for age between two study periods (1982-83 and 1999-2001) :

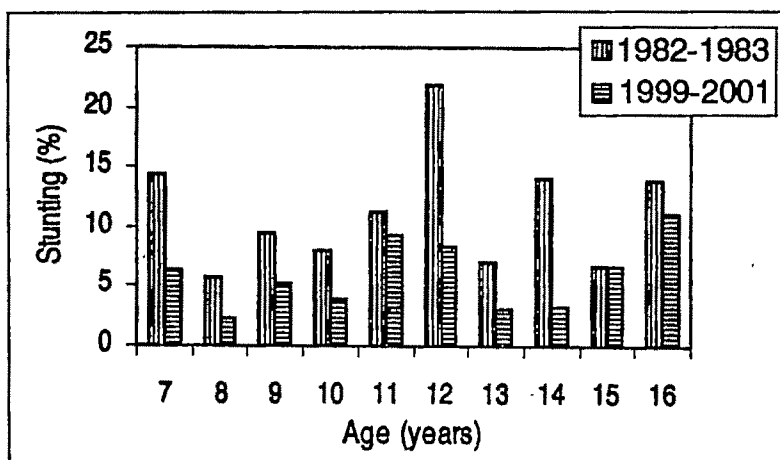


Figure 2 : Secular trends in the prevalence of stunting as determined by < -2z score of stature for age between two study periods (1982-83 and 1999-2001) :

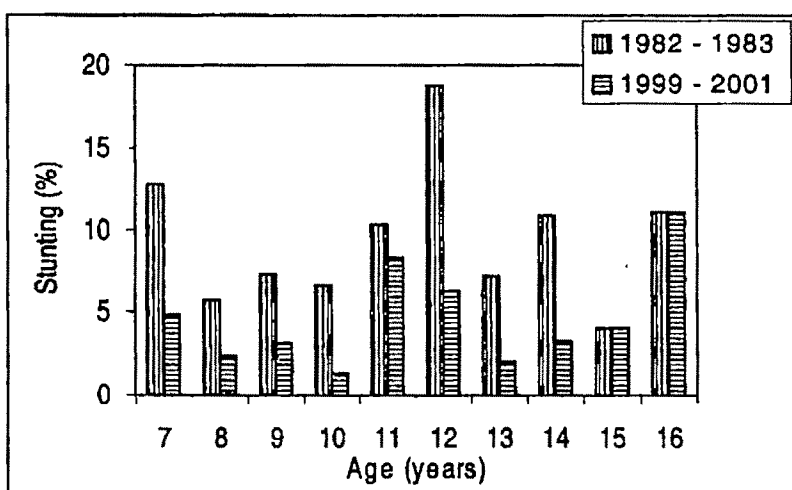


Figure 3 : Secular trends in the prevalence of thinning between two study periods (1982-83 and 1999-2001) :

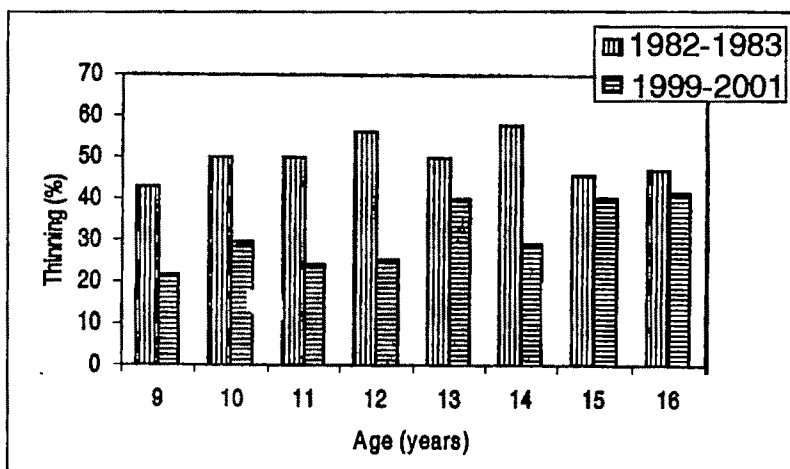


Figure 4 : Secular trends in the prevalence of overweight between two study periods (1982-83 and 1999-2001) :

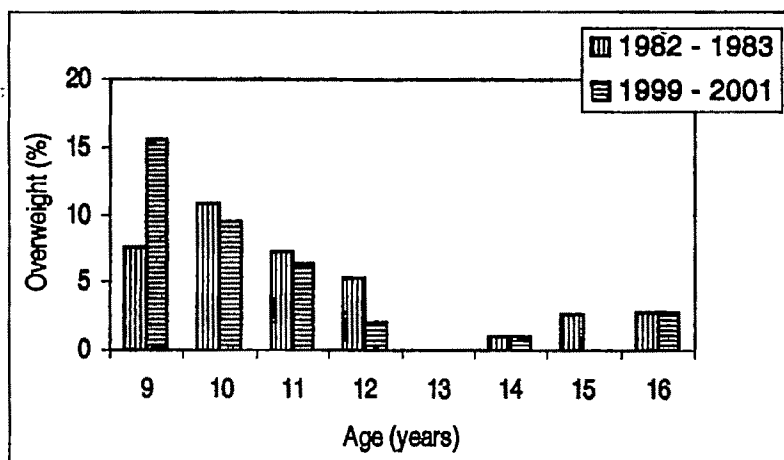


Figure 5 : Secular trends in mean Body Mass Index (kg/m^2) between the study periods (1982-83 to 1999-2001) :

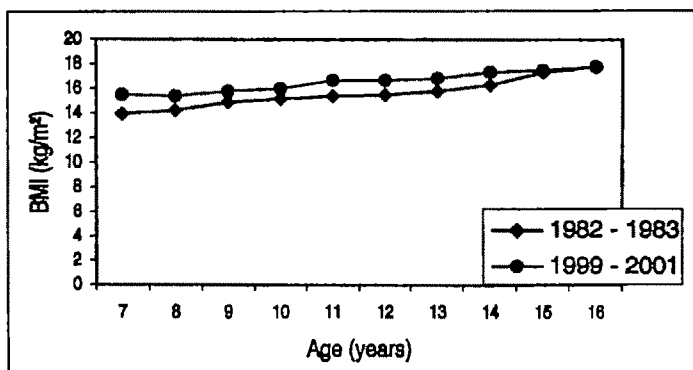


Figure 6 : Secular trends in mean triceps skinfold thinning (mm) between the study periods (1982-83 to 1999-2001) :

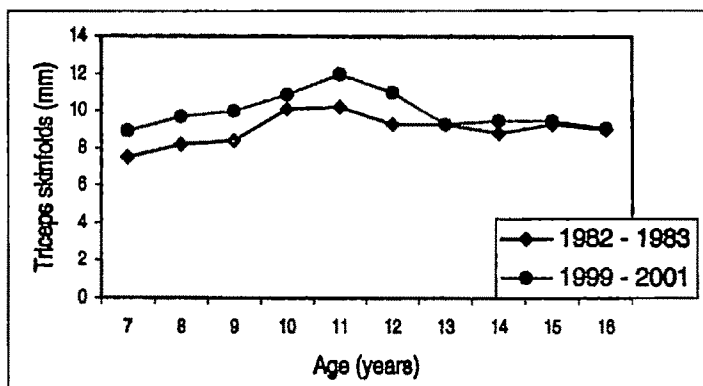
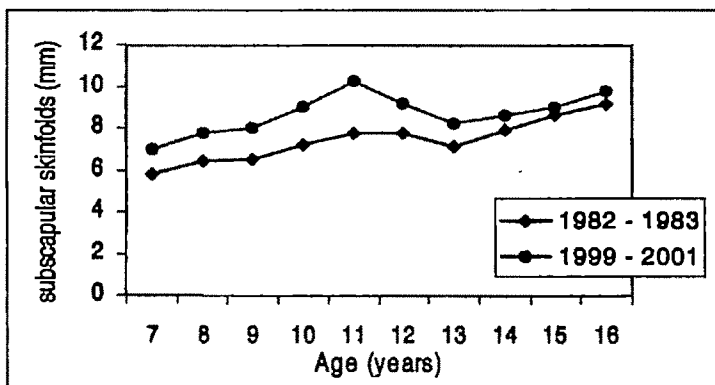


Figure 7 : Secular trends in mean subscapular skinfold thinning (mm) between the study periods (1982-83 to 1999-2001) :



Growth in the first year: Percentiles for crown-heel length, weight and head circumference and their monthly increments among the Punjabi infants.

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Abstract : Longitudinal data on 154 Punjabi infants (86 males and 68 females) have been used to develop distance and one-month increment percentiles (5th, 10th, 25th, 50th, 75th, 90th and 95th) for crown-heel length, weight and head circumference for both the sexes. Sex-specific Weight-for-CHL percentiles have also been computed (where this statistic assumes approximate age independence during infancy). Because the distance and velocity distributions of the above three variables in the present sample do not have exact normal distributions as indicated by their skewness and kurtosis values, it has been shown that the computed percentiles can still be used as approximations for reference data for population comparisons.

Keywords : Distance and velocity percentile curves; skewness and kurtosis; weight-for-CHL curves.

Introduction :

Growth standards or growth charts are not appropriate as an index of the health and nutrition of a population believed to be at risk, but are a powerful device for investigating groups of children (at the individual level) who are not overtly ill to see which individuals might benefit from special care (Tanner, 1986). These growth charts, including the NCHS standards that are derived from a cross-section of ethnic and economic groups, can be regarded simply as 'reference' standards. Further, appraisal of the infantile growth and development is useful only if the data are accurate and continuous in each of the areas in which changes can be observed. The use of percentile charts in nutritional screening and clinical assessment of growing infants and children has been widely accepted and recommended (Meredith, 1955; NCHS, 1977; Tanner, 1986; Kato and Takaishi, 2001; Pérez *et al.*, 2001)

The most useful physical measurements usually utilized in analyzing infant growth are head circumference (HC), crown-heel length (CHL) and weight (W). This paper presents sex-specific distance and velocity percentile curves for these three measures of 154 Punjabi infants (86 males and 68 females) along percentile curves for weight for CHL (assuming approximately age independence for this statistic) for both the sexes.

Materials and methods:

Serial monthly measurements of three anthropometric variables, CHL, HC and W, on 154 Punjabi infants were made in the growth and neo-natal follow-up clinics of the PGIMER between 1978 and 1981 by one of the authors (AKB). The sampling techniques adopted

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have already been described (Bhalla *et al.*, 1986, 1987). The variability statistics namely, mean, standard deviation, co-efficient of variation and the more effective measures of dispersion i.e., skewness and kurtosis, have been computed for the three variables (Tables: 1 and 2, 5 and 6, 9 and 10) and their 1-monthly increments (Tables: 3 and 4, 7 and 8, 11 and 12).

Mean and standard deviation (SD) of a distribution of values provide the exact form of the normal curve. In other words, there can be different normal curves, one for every combination of mean and SD. Normal curves can have the same SDs but different means and at the same time, can have different SDs but the same mean. However, the smaller the SD, the more peaked the curve. Relatively, better measures of dispersion of a data around the mean are the *skewness* and *kurtosis*. While skewness is a measure of symmetry around the mean, kurtosis is a measure of peakedness of the distribution curve i.e., the number of individuals near the mean. In statistical terms, for a normal/Gaussian population skewness and kurtosis should be absent or, equal to zero (Croxtton, 1953).

Results and discussion:

The means, standard deviations, co-efficients of variation and the values for skewness and kurtosis have been computed for the three variables i.e., CHL, weight and HC (Tables: 1 and 2, 5 and 6, 9 and 10) and their 1-monthly increments (Tables: 3 and 4, 7 and 8, 11 and 12) for both the sexes. The statistics of the variables and their increments in terms of average increases during the first and last halves of the year as well as over the whole year, and some of the correlations have been discussed in Kaul and Bhalla (2000) and Bhalla *et al.* (1986). Body growth is much more rapid during the first six months after birth than during the succeeding six months, being less than half as large for the three measures. With the exception of the earliest month of life, the increments generally decrease with age. In both male and female infants, the increments in body weight are higher in second than during the first month. For CHL and HC the greatest increments are seen between birth and first month of life in both sexes. Thereafter, the growth velocity generally slows down (Tables: 3 and 4, 7 and 8, 11 and 12). Sexual dimorphism indicates that differences between male and female infants according to age are not unidirectional for absolute values as well as for increments.

The SD values of body weight generally increase with age upto 8 months in male infants and upto 11 months in female infants (Tables: 1 and 2, 5 and 6, 9 and 10). The SDs for CHL increase among male infants during the first quarter of infancy followed by a general decrease with age over the next four months. For female infants, the SDs for CHL depict an increase with age upto the first four months to be followed by a decreasing tendency in the next two months. A similar undulating tendency in the SD values for HC is also visualized for both the sexes. The SDs of increments (Tables: 3 and 4, 7 and 8, 11 and 12), thus, generally show a decreasing tendency with age and no perceptible sex differences are seen. This suggests that the average child tends to remain in his or her individual development 'canal'.

The skewness and kurtosis values for the present data of variables and their 1-monthly increments reveal skewed and kurtotic distributions, more so for the increments. Thus, the

sample of Punjabi infants does not show exact normal distributions for the three variables as indicated by the measures of dispersion calculated using moments i.e., skewness and kurtosis. The frequency distribution curves for the three variables and their 1-monthly increments were also made at all ages in the course of data analyses but none showed a symmetrical distribution.

Meredith (1955) used percentiles to check normality of a distribution of values or, whether the distribution curve was symmetrical or, bell-shaped. He described the distribution as normal if the difference between the 5th and the 25th percentile was similar to that between the 75th and the 95th percentile. Following this method, difference between the 5th and the 25th percentiles was compared with that between the 75th and the 95th percentiles for the three variables and their 1-monthly increments for both the sexes.

The mean differences are shown below-

Variable	Sex	25 th -5 th percentile	95 th -75 th percentile
CHL	M	2.8	2.5
	F	2.3	2.1
HC	M	1.0	1.2
	F	1.2	1.3
W	M	0.6	0.9
	F	0.8	0.8
<i>1-Monthly increment</i>			
CHL	M	0.8	1.0
	F	0.8	1.0
HC	M	0.4	0.5
	F	0.4	0.6
W	M	0.2	0.2
	F	0.3	0.3

It can be seen from the above that the distance and velocity curves are more or less symmetrical or bell-shaped for most of the variables. In the Harvard and Iowa charts and the NCHS (1977) growth charts, percentiles rather than SDs are used. Percentiles and SD scores are equivalent if, and only if, the distribution of the variable is Gaussian or normal. If the variable is skewed, which is the case for most of growth data (Vaughan, 1979), then SD scores cannot be interpreted at all, and in this sense are erroneous (Healy *et al.*, 1988). NCHS (1977) investigated and rejected the Pearson distribution system (using moments to calculate skewness and kurtosis, which were then converted to z-values to estimate percentiles) as it was found to be less sensitive to changes in the derivatives. This method was found to be highly sensitive to outliers, whereas the percentile method was found to be independent of the shape of the underlying distribution.

Thus, percentiles offer some "commonality" or "parallelism" between the curves for skewed or non-normal distributions that helps in the use of data as 'reference' standards for inter-population comparisons.

Distance and Velocity Percentiles: Distance curves for CHL of Punjabi infants

according to age for both the sexes show a rapid increase upto 5-6 months followed by a gradual increase thereafter (Figs. 1 and 2). The same is observed for Weight-for-Age (Figs. 5 and 6) and HC-for-Age (Figs. 9 and 10) percentile curves. Sexual dimorphism observed has been reported earlier (Bhalla *et al.*, 1985a, 1985b; Kumar and Bhalla, 1988; Bhalla and Walia, 1993).

Growth monitoring is done to pick up ill health or detect any growth discrepancies at an early stage and thus, incremental or velocity standards are more powerful than distance ones (Tanner, 1986; Boryslawski, 1988; Roche *et al.*, 1989). For example, a child who is at the 90th percentile for height at one age and then fails to grow at all in the next time interval, will still be at say, the 50th or at the most may fall down to the 10th percentile and would still not be considered abnormally short. But, such cases can be easily detected using velocity percentiles. When trying to compare different somatic variables with respect to their dynamics, they need to be standardized; otherwise differences in size will dominate the picture. Velocity percentiles give the correct interpretation while the use of distance percentiles leads to bias (Tanner, 1986; Gasser *et al.*, 1991).

The velocity percentile curves for CHL-for-Age for the Punjabi male and female infants are presented in Figs. 3 and 4. The increments decrease rapidly with age for the first 6 months, after which the decreases are much slower and more nearly linear. The Weight-for-Age velocity curves show an increase until the 2nd increment (2-3 months) in both the sexes, followed by a fast decrease until 6-7 months and a gradual flattening of the curve thereafter. The 10th percentile even registers negative increments from 9th to 12th month in males and 9th to 11th month in females (Figs. 7 and 8). HC-for-Age velocity percentile curves for both the sexes (Figs. 11 and 12) more or less follow the same pattern as that for CHL-for-Age velocity curves. A notable kink in the curve is noted at the 5th increment level in both the sexes, whereafter the curve smoothens out.

Roche *et al.* (1989) have also reported this trend of a rapid fall in the increment curves until the 6th month of infancy and stable increments in the later 6 months of infancy for weight and recumbent length. The pattern of change was more or less similar for both the sexes, though the increments in all the three variables with age are higher for boys than for girls. Tanner (1994) also reports similar trends in longitudinal data derived from studies made on European infants.

‘Weight-for-CHL’ Percentile Curves: The Weight-for-Length percentiles have been derived assuming an approximate independence of chronological age from infancy until the occurrence of the marked changes in body proportions that begin in early pubescence i.e., at 4 years of age (NCHS, 1977). Its immediate practical use is for those areas of the world where the children being assessed do not have accurately recorded birth dates, though this problem does not arise for the present data as the children were measured at birth also. The construction of Weight-for-CHL curves, following NCHS (1977), pools all the data from birth to 12 months of age and rearranges them in length intervals by 5-centimeter groupings. Within each 5-centimeter grouping, the associated body weights are then arranged in the seven percentile curves viz., 5th, 10th, 25th, 50th, 75th, 90th and 95th.

The observed percentiles of weight for CHL of Punjabi male and female infants are depicted in Tables 13 and 14, and the derived percentile curves are shown in Figs. 13 and

14. The weights of Punjabi infants (males and females) show a gradual increase with increasing height. The observed Weight-for-CHL percentiles have lesser values at all heights than the NCHS percentile values. It is clear that at the same height the NCHS infants are much heavier at all percentiles than the Punjabi infants.

In the evaluation of developmental or nutritional status of children, Weight-for-CHL data seem to be particularly informative in conjunction with data relating height-to-age. For example, children with low Heights-for-Age who have normal Weight-for-Height may have experienced nutritional or growth failure in the past, whereas if both Height-for-Age and Weight-for-Height are strikingly low, then both past and current nutritional or growth failure may be suspected. By contrast, children with normal Height-for-Age who have conspicuously low Weight-for-Height are likely to have either a relatively acute nutritional or growth problem or a variant physique (Vaughan, 1979). Since age independence of the above relationship is assumed close enough, body weight distributed according to CHL groupings is a recommended statistical device for classifying populations especially into various categories of nutritionally related growth disturbances (NCHS, 1977).

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Table 1 : Central tendency, variability statistics and percentiles of Height (cm.) according to monthly ages of Punjabi Male Infants.

Age (in months)	Height (in cm.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0	49.06	1.74	3.56	-0.894**	0.742	45.58	46.29	47.54	49.30	50.26	50.88	51.34
1	53.84	2.34	4.34	-0.857**	3.284	50.08	51.10	52.5	53.74	55.32	56.28	57.70
2	57.45	2.36	4.12	-0.474**	0.518	52.65	54.43	56.16	57.44	58.82	60.42	60.96
3	60.48	2.48	4.09	-0.269*	0.193	56.08	57.20	58.95	60.36	61.96	63.63	64.43
4	62.81	2.42	3.85	-0.146	0.289	58.43	59.65	61.34	62.75	64.21	65.85	66.93
5	64.61	2.44	3.78	0.079	0.339	59.77	61.60	63.20	64.27	66.14	67.85	68.62
6	66.22	2.40	3.63	-0.018	0.205	61.77	63.36	64.65	66.00	67.71	69.13	70.43
7	67.78	2.39	3.53	0.219*	0.499	63.65	64.90	66.17	67.53	69.27	70.85	71.74
8	69.02	2.49	3.62	-0.001	0.169	64.32	65.53	67.45	69.05	70.35	71.91	73.23
9	70.23	2.51	3.58	0.162*	0.097	65.77	66.90	68.47	70.08	71.81	73.28	74.35
10	71.49	2.52	3.52	-0.013	0.171	66.82	68.12	70.04	71.41	72.85	74.55	75.35
11	72.67	2.50	3.44	0.085	0.436	68.15	69.65	71.19	72.58	73.96	75.68	76.90
12	73.87	2.49	3.37	0.131	0.551	69.77	70.90	72.05	73.71	75.25	76.84	77.90

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 2 : Central tendency, variability statistics and percentiles of Height (cm.) according to monthly ages of Punjabi Female Infants.

Age (in months)	Height (in cm.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0	48.96	1.64	3.53	0.136	0.329	46.35	47.04	47.55	48.50	49.75	51.20	51.77
1	53.32	1.87	3.51	-0.137	-0.003	50.23	50.80	51.82	53.30	54.33	55.84	56.52
2	57.04	2.27	3.98	-0.035	-0.530	53.40	54.28	55.23	56.88	58.71	60.04	60.72
3	59.70	2.46	4.12	-0.353*	-0.181	55.70	56.47	58.08	59.50	61.57	63.63	63.52
4	61.82	2.51	4.07	-0.262*	-0.131	58.08	58.76	60.17	61.78	63.67	65.04	65.72
5	63.76	2.29	3.59	-0.132	-0.518	59.47	60.60	62.27	63.75	65.42	66.64	67.40
6	65.35	2.28	3.48	-0.141	-0.541	61.70	62.40	63.75	65.20	67.00	68.24	68.92
7	66.80	2.51	3.76	0.075	-0.324	62.35	63.27	65.17	66.50	68.55	70.17	70.66
8	68.06	2.53	3.71	0.143	0.104	63.70	64.93	66.40	67.79	69.75	71.05	71.90
9	69.44	2.63	3.79	0.277*	0.473	65.20	66.22	67.44	69.30	71.22	72.64	73.53
10	70.53	2.71	3.85	0.204*	-0.158	65.80	66.93	68.60	70.33	72.43	73.78	74.80
11	71.60	2.67	3.73	0.033	-0.564	66.85	67.70	69.63	71.43	73.50	74.89	75.65
12	72.78	2.58	3.54	-0.086	-0.591	67.85	69.30	71.13	72.71	74.50	76.03	76.60

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 3 : Central tendency, variability statistics and percentiles of 1-Monthly increments of Height (cm.) of Punjabi Male Infants.

1-Monthly Increment	Height Increment (in cm.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0 - 1	4.90	1.94	39.56	0.81**	1.29	1.86	2.38	3.39	4.68	6.05	7.43	7.96
1 - 2	3.61	1.72	47.55	2.95**	18.69	1.08	2.03	2.75	3.49	4.18	4.86	5.42
2 - 3	3.03	1.06	35.06	0.13	0.60	1.03	1.51	2.34	3.13	3.70	4.20	4.81
3 - 4	2.32	0.86	37.17	-0.01	0.08	0.86	1.12	1.57	2.23	2.78	3.37	3.72
4 - 5	1.80	0.79	43.86	0.61**	0.76	0.25	0.51	1.12	1.68	2.37	2.86	3.17
5 - 6	1.61	0.76	47.75	0.43**	0.01	0.20	0.39	0.98	1.48	1.97	2.76	3.14
6 - 7	1.56	0.75	48.33	0.47**	0.35	0.23	0.45	1.05	1.47	1.89	2.62	2.97
7 - 8	1.32	0.86	65.59	1.28**	2.33	0.12	0.24	0.60	1.17	1.71	2.23	2.78
8 - 9	1.21	0.75	62.57	2.79**	15.09	0.13	0.27	0.67	1.22	1.65	1.91	1.99
9 - 10	1.26	0.68	53.77	0.53**	0.29	0.13	0.27	0.67	1.25	1.72	2.06	2.67
10 - 11	1.17	0.63	53.89	0.18*	-0.33	0.12	0.23	0.58	1.14	1.64	1.94	2.28
11 - 12	1.20	1.29	107.19	6.18**	47.73	0.12	0.25	0.61	1.17	1.64	1.92	2.17

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 4 : Central tendency, variability statistics and percentiles of 1-Monthly increments of Height (cm.) of Punjabi Female Infants.

Height Increment (in cm.)												
1-Monthly Increment	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0 - 1	4.35	1.54	32.53	0.23*	0.16	1.40	1.97	3.15	4.27	5.08	5.93	7.20
1 - 2	3.72	1.07	28.93	-0.15*	0.19	1.80	2.07	2.81	3.61	4.53	5.32	5.66
2 - 3	2.66	1.06	40.16	0.14	-0.05	0.57	1.06	1.85	2.48	3.09	4.03	4.60
3 - 4	2.11	0.94	44.78	0.76**	0.68	0.57	1.02	1.34	1.88	2.65	3.53	4.15
4 - 5	1.96	0.92	46.98	0.18	0.06	0.24	0.49	1.15	2.00	2.61	2.97	3.65
5 - 6	1.59	0.82	51.59	1.51**	3.04	0.19	0.38	0.94	1.43	1.89	2.69	3.20
6 - 7	1.46	0.71	49.07	0.86**	1.20	0.19	0.38	0.94	1.39	1.80	2.28	2.70
7 - 8	1.25	0.54	43.50	1.15**	2.26	0.12	0.24	0.61	1.17	1.64	1.92	2.30
8 - 9	1.40	0.56	39.98	-0.40*	-0.46	0.19	0.38	0.94	1.36	1.73	1.96	2.32
9 - 10	1.09	0.57	52.18	0.72**	1.35	0.11	0.22	0.55	1.09	1.59	1.89	1.99
10 - 11	1.07	0.60	56.24	1.22**	4.46	0.11	0.22	0.55	1.09	1.59	1.89	1.99
11 - 12	1.18	0.72	60.57	0.61**	0.36	0.11	0.23	0.57	1.13	1.66	1.98	2.52

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 5 : Central tendency, variability statistics and percentiles of Weight (kg.) according to monthly ages of Punjabi Male Infants.

Age (in months)	Weight (in kg.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0	2.94	0.35	11.86	0.778**	-0.267	2.53	2.56	2.65	2.83	3.15	3.42	3.54
1	3.84	0.48	12.61	-0.017	0.294	3.05	3.23	3.57	3.79	4.09	4.51	4.67
2	4.81	0.57	12.01	-0.007	0.176	3.89	4.08	4.41	4.71	5.19	5.59	5.86
3	5.61	0.66	11.75	0.441**	0.269	4.76	4.85	5.11	5.52	5.99	6.46	6.73
4	6.30	0.72	11.48	0.475**	0.552	5.19	5.47	5.79	6.22	6.71	7.16	7.39
5	6.86	0.84	12.25	0.318*	-0.293	5.44	5.83	6.20	6.75	7.38	8.03	8.39
6	7.35	0.90	12.24	0.276*	-0.297	6.01	6.23	6.63	7.33	7.88	8.53	8.96
7	7.69	0.97	12.66	0.404**	-0.137	6.21	6.40	6.91	7.63	8.30	8.96	9.39
8	7.99	1.06	13.35	0.349**	0.143	6.39	6.72	7.16	7.91	8.57	9.40	9.72
9	8.26	1.05	12.75	0.344**	-0.210	6.66	6.88	7.43	8.21	8.93	9.62	9.97
10	8.50	0.98	11.63	0.262*	-0.528	7.01	7.23	7.66	8.45	9.21	9.69	10.17
11	8.74	1.00	11.45	0.253*	-0.802	7.26	7.41	7.84	8.68	9.55	10.03	10.46
12	8.95	1.01	11.35	0.302*	-0.849	7.41	7.63	8.07	8.88	9.68	10.23	10.67

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 6 : Central tendency, variability statistics and percentiles of Weight (kg.) according to monthly ages of Punjabi Female Infants.

Age (in months)	Weight (in kg.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0	2.99	0.34	11.52	0.629**	-0.322	2.54	2.59	2.72	2.91	3.22	3.46	3.60
1	3.80	0.58	13.39	1.103**	3.340	2.92	3.12	3.38	3.73	4.11	4.42	4.57
2	4.63	0.54	11.78	0.219*	-0.418	3.77	3.91	4.20	4.58	4.98	5.36	5.49
3	5.35	0.62	11.73	0.333*	0.183	4.30	4.57	4.90	5.32	5.78	6.09	6.23
4	5.95	0.68	11.52	0.266*	0.713	4.78	4.99	5.52	5.88	6.38	6.77	7.07
5	6.54	0.74	11.34	0.302*	0.097	5.32	5.49	6.05	6.45	7.05	7.44	7.70
6	7.02	0.86	12.34	0.245*	-0.147	5.46	5.73	6.42	6.90	7.60	8.15	8.47
7	7.35	0.93	12.74	0.252*	0.075	5.84	6.10	6.78	7.30	7.92	8.52	9.05
8	7.65	0.94	12.27	0.194	-0.248	6.03	6.24	7.07	7.47	8.25	8.89	9.40
9	7.90	0.96	12.21	0.302*	0.077	6.28	6.49	7.31	7.75	8.45	9.15	9.47
10	8.18	0.96	11.82	0.345*	0.677	6.46	6.73	7.56	8.09	8.81	9.35	9.80
11	8.47	0.98	11.58	0.405*	0.978	6.80	7.11	7.88	8.50	9.04	9.60	10.07
12	8.73	0.96	11.01	0.181	0.402	7.05	7.54	8.17	8.69	9.30	9.95	10.16

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 7 : Central tendency, variability statistics and percentiles of 1-Monthly increments of Weight (kg.) of Punjabi Male Infants.

1-Monthly Increment	Weight Increment (in kg.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0 – 1	0.90	0.38	42.56	–0.68**	0.84	0.12	0.32	0.71	0.90	1.11	1.29	1.43
1 – 2	0.97	0.26	27.54	0.65**	1.21	0.52	0.59	0.77	0.93	1.14	1.33	1.42
2 – 3	0.79	0.29	37.48	–0.26*	0.44	0.26	0.38	0.60	0.81	0.95	1.16	1.28
3 – 4	0.69	0.23	33.97	0.34*	0.23	0.27	0.35	0.53	0.66	0.84	1.01	1.15
4 – 5	0.55	0.26	48.17	–0.12	–0.44	0.10	0.24	0.36	0.55	0.74	0.90	0.96
5 – 6	0.49	0.29	59.76	0.79**	2.85	0.02	0.10	0.28	0.42	0.63	0.86	0.97
6 – 7	0.34	0.20	59.61	0.32**	2.11	–0.03	0.04	0.19	0.33	0.44	0.51	0.65
7 – 8	0.30	0.23	77.21	–1.27**	6.55	0.00	0.04	0.14	0.30	–0.44	0.59	0.69
8 – 9	0.26	0.19	70.90	0.33**	0.59	–0.10	0.01	0.10	0.24	0.40	0.49	0.61
9 – 10	0.23	0.21	90.73	–0.04	1.07	–0.20	–0.10	0.07	0.23	0.39	0.48	0.58
10 – 11	0.24	0.20	53.89	0.04	1.09	–0.16	–0.07	0.08	0.25	0.40	0.48	0.58
11 – 12	0.22	0.15	70.52	–0.69**	3.51	–0.14	0.02	0.08	0.17	0.30	0.43	0.48

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 8 : Central tendency, variability statistics and percentiles of 1-Monthly increments of Weight (kg.) of Punjabi Female Infants.

1-Monthly Increment	Weight Increment (in kg.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0 – 1	0.77	0.38	49.50	-0.19	0.29	0.09	0.27	0.48	0.76	0.96	1.29	1.41
1 – 2	0.85	0.25	29.32	0.27*	1.36	0.35	0.49	0.66	0.84	0.98	1.18	1.32
2 – 3	0.72	0.25	35.32	0.28*	-0.64	0.30	0.36	0.51	0.7	0.92	1.11	1.19
3 – 4	0.59	0.25	43.59	1.20**	3.04	0.17	0.27	0.38	0.55	0.69	0.86	1.07
4 – 5	0.58	0.25	43.95	-0.51**	1.89	0.06	0.2	0.41	0.59	0.71	0.87	0.96
5 – 6	0.48	0.27	57.86	1.36**	3.75	0.08	0.18	0.3	0.41	0.55	0.8	0.94
6 – 7	0.33	0.24	73.17	0.11	2.41	-0.16	0.01	0.2	0.34	0.45	0.59	0.73
7 – 8	0.30	0.16	56.41	0.39**	1.05	0.00	0.04	0.14	0.29	0.41	0.49	0.60
8 – 9	0.24	0.21	87.37	-1.28**	5.59	-0.15	-0.01	0.08	0.2	0.38	0.49	0.61
9 – 10	0.27	0.28	103.98	0.72**	5.06	-0.24	-0.13	0.07	0.25	0.42	0.58	0.70
10 – 11	0.29	0.22	76.07	-0.41**	2.20	-0.13	0.02	0.1	0.25	0.41	0.51	0.65
11 – 12	0.25	0.21	83.54	1.33**	4.30	-0.11	0.01	0.07	0.19	0.36	0.49	0.63

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 9 : Central tendency, variability statistics and percentiles of Head circumference (cm.) according to monthly ages of Punjabi Male Infants.

Age (in months)	Head Circumference (in cm.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0	33.95	1.02	3.01	-0.510**	-0.095	31.88	32.36	33.16	33.94	34.63	35.19	35.43
1	36.55	1.11	3.03	-0.241*	1.001	35.01	35.23	35.81	36.50	37.28	37.90	38.22
2	38.26	1.02	2.68	-0.022	0.226	36.61	36.97	37.57	38.18	38.89	39.54	39.97
3	39.63	1.09	2.76	-0.092	-0.274	37.72	38.19	38.83	39.54	40.38	40.97	41.46
4	40.76	1.44	3.53	-2.455**	13.923	39.02	39.29	40.04	40.73	41.60	41.98	42.46
5	41.73	1.17	2.80	0.132	0.084	39.79	40.16	40.84	41.77	42.46	43.12	43.47
6	42.63	1.22	2.88	0.239*	0.203	40.63	41.03	41.70	42.54	43.39	44.17	44.48
7	43.28	1.26	2.92	0.393**	0.485	41.28	41.60	42.46	43.24	43.95	44.74	45.17
8	43.78	1.23	2.81	0.484**	0.684	41.78	42.10	42.83	43.77	44.43	44.97	45.67
9	44.21	1.24	2.82	0.637**	0.891	42.21	42.47	43.17	44.22	44.87	45.47	45.96
10	44.67	1.24	2.77	0.094	0.807	42.73	43.07	43.67	44.64	45.30	45.91	46.45
11	45.06	1.23	2.75	0.630**	1.152	43.11	43.47	44.11	45.03	45.73	46.40	47.17
12	45.60	1.74	3.82	2.295**	9.011	43.57	43.81	44.43	45.38	46.19	47.17	48.85

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 10 : Central tendency, variability statistics and percentiles of Head circumference (cm.) according to monthly ages of Punjabi Female Infants.

Age (in months)	Head Circumference (in cm.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0	33.72	0.93	2.76	-0.369**	0.185	31.80	32.45	33.14	33.66	34.14	34.79	34.98
1	35.94	1.06	2.96	-0.183	-0.023	33.90	34.35	35.33	35.88	36.65	37.23	37.47
2	37.71	1.16	3.09	-0.553**	1.426	35.62	35.90	37.21	37.75	38.29	38.87	39.27
3	38.94	1.35	3.48	-0.143	1.684	36.85	37.28	38.14	38.85	39.57	40.62	40.96
4	39.91	1.31	3.29	-0.001	0.469	37.74	38.08	39.06	39.88	40.63	41.53	41.95
5	40.95	1.32	3.24	0.256*	0.055	38.90	39.23	39.89	41.03	41.67	42.65	43.30
6	41.72	1.38	3.31	0.284*	-0.487	39.54	39.88	40.56	41.57	42.69	43.43	44.15
7	42.40	1.35	3.20	0.121	-0.732	40.20	40.48	41.25	42.5	43.33	44.05	44.70
8	42.84	1.42	3.33	0.061	-0.604	40.53	40.77	41.71	42.86	43.78	44.65	45.30
9	43.34	1.41	3.26	0.091	-0.505	41.03	41.27	42.17	43.32	44.10	45.03	45.80
10	43.71	1.38	3.15	0.042	-0.378	41.40	41.73	42.6	43.73	44.46	45.35	45.90
11	44.13	1.41	3.20	0.060	-0.136	41.85	42.23	43.00	44.14	44.95	45.72	46.30
12	44.39	1.41	3.19	0.221*	0.269	42.14	42.48	43.33	44.42	45.14	45.93	46.80

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 11 : Central tendency, variability statistics and percentiles of 1-Monthly increments of Head circumference (cm.) of Punjabi Male Infants.

1 (Monthly Increment)	Head Circumference (in cm.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0 – 1	2.59	1.09	42.38	0.69**	1.14	0.78	1.13	1.80	2.55	3.13	4.05	4.67
1 – 2	1.71	0.55	32.73	0.26*	1.48	0.61	0.97	1.27	1.66	1.98	2.38	2.59
2 – 3	1.37	0.55	40.69	0.25*	-0.05	0.43	0.59	0.89	1.29	1.70	1.97	2.34
3 – 4	1.24	0.56	45.35	2.98**	18.18	0.27	0.54	0.90	1.20	1.44	1.78	1.91
4 – 5	0.97	0.84	86.71	6.42**	50.16	0.11	0.23	0.53	0.81	1.13	1.39	1.47
5 – 6	0.90	0.45	50.30	1.24**	3.25	0.13	0.27	0.56	0.81	1.13	1.48	1.81
6 – 7	0.64	0.30	46.92	0.54**	0.61	0.06	0.13	0.32	0.60	0.83	0.97	1.14
7 – 8	0.51	0.25	50.54	0.12	-0.43	0.05	0.10	0.24	0.48	0.74	0.91	0.96
8 – 9	0.42	0.23	54.56	0.32**	1.30	0.03	0.06	0.16	0.32	0.48	0.79	0.91
9 – 10	0.46	0.24	53.05	0.87**	1.41	0.04	0.08	0.20	0.41	0.69	0.91	0.98
10 – 11	0.39	0.31	79.56	3.52**	19.05	0.03	0.06	0.15	0.30	0.45	0.73	0.90
11 – 12	0.60	1.24	207.39	5.76**	36.34	0.03	0.06	0.16	0.31	0.47	0.85	0.99

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 12 : Central tendency, variability statistics and percentiles of 1-Monthly increments of Head circumference (cm.) of Punjabi Female Infants.

I (Monthly Increment)	Head Circumference (in cm.)											
	Mean	S.D.	C.V.	Skewness	Kurtosis	Percentiles						
						5th	10th	25th	50th	75th	90th	95th
0 – 1	2.22	0.94	42.67	0.65**	0.24	0.74	1.04	1.53	1.97	2.75	3.53	4.10
1 – 2	1.76	0.67	38.38	–0.08	–0.04	0.54	0.88	1.30	1.70	2.00	2.66	2.90
2 – 3	1.22	0.57	47.01	0.24*	–0.15	0.21	0.43	0.75	1.17	1.58	2.02	2.30
3 – 4	0.96	0.45	46.53	0.61**	0.92	0.17	0.34	0.60	0.84	1.19	1.52	1.80
4 – 5	1.04	0.43	41.13	0.64**	0.56	0.28	0.51	0.68	0.97	1.33	1.66	1.90
5 – 6	0.77	0.29	38.32	–0.31**	0.30	0.14	0.28	0.55	0.72	0.90	1.01	1.26
6 – 7	0.69	0.30	44.83	0.20*	–0.18	0.08	0.15	0.39	0.67	0.90	1.16	1.33
7 – 8	0.44	0.28	62.93	0.84**	0.39	0.03	0.07	0.17	0.35	0.56	0.88	0.99
8 – 9	0.50	0.29	59.25	1.08**	1.49	0.04	0.08	0.20	0.40	0.68	0.91	0.99
9 – 10	0.37	0.23	63.30	0.75**	0.58	0.03	0.06	0.15	0.31	0.46	0.76	0.90
10 – 11	0.41	0.32	78.96	2.77**	12.17	0.03	0.06	0.16	0.31	0.47	0.80	0.94
11 – 12	0.35	0.36	103.28	4.66**	28.06	0.03	0.05	0.14	0.27	0.41	0.49	0.82

* significant at $p < 0.10$

** significant at $p < 0.02$

Table 13 : Percentiles of Weight-for-Crown-Heel Length of Punjabi Male Infants.

Height (in cms.)	Weight percentiles (in Kg.)						
	5th	10th	25th	50th	75th	90th	95th
43 – 47	2.53	2.56	2.65	2.81	2.96	3.35	4.10
47 – 51	2.54	2.58	2.71	2.91	3.23	3.47	3.73
51 – 55	3.09	3.21	3.53	3.77	4.02	4.39	4.58
55 – 59	3.71	3.92	4.30	4.71	5.07	5.44	5.69
59 – 63	4.84	5.05	5.36	5.75	6.17	6.57	6.85
63 – 67	5.88	6.08	6.40	6.90	7.38	7.80	7.97
67 – 71	6.53	6.83	7.32	7.90	8.41	8.92	9.25
71 – 75	7.47	7.65	8.13	8.78	9.40	9.87	10.08
75 – 82	8.81	9.08	9.46	10.02	10.55	11.05	11.27

Table 14 : Percentiles of Weight-for-Crown-Heel Length of Punjabi Female Infants.

Height (in cms.)	Weight percentiles (in Kg.)						
	5th	10th	25th	50th	75th	90th	95th
43 – 47	2.52	2.53	2.58	2.65	2.72	2.85	2.92
47 – 51	2.54	2.58	2.71	2.92	3.24	3.47	3.69
51 – 55	2.96	3.08	3.35	3.80	4.26	4.66	5.05
55 – 59	3.68	3.86	4.21	4.65	5.10	5.46	5.77
59 – 63	4.65	4.88	5.24	5.70	6.18	6.61	6.90
63 – 67	5.58	5.81	6.26	6.78	7.32	7.84	8.14
67 – 71	6.60	6.93	7.28	7.77	8.32	8.77	8.96
71 – 75	7.50	7.77	8.23	8.73	9.27	9.75	9.94
75 – 82	8.53	8.73	9.14	9.60	10.33	11.30	11.70

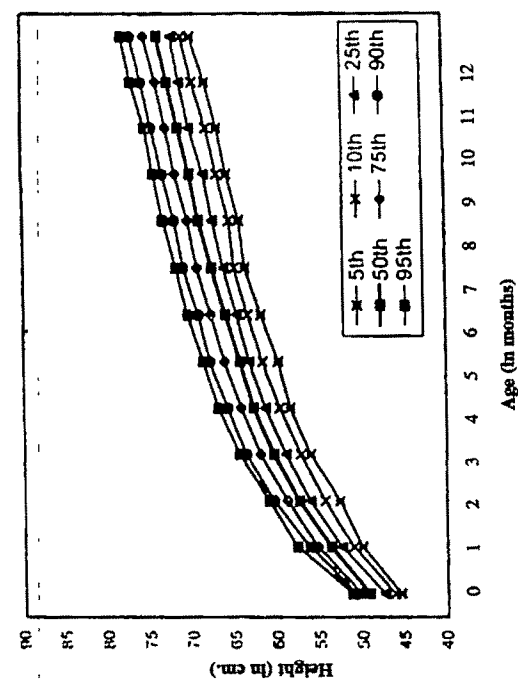


Fig. 1 Height-for-Age Percentiles of Punjabi Male Infants

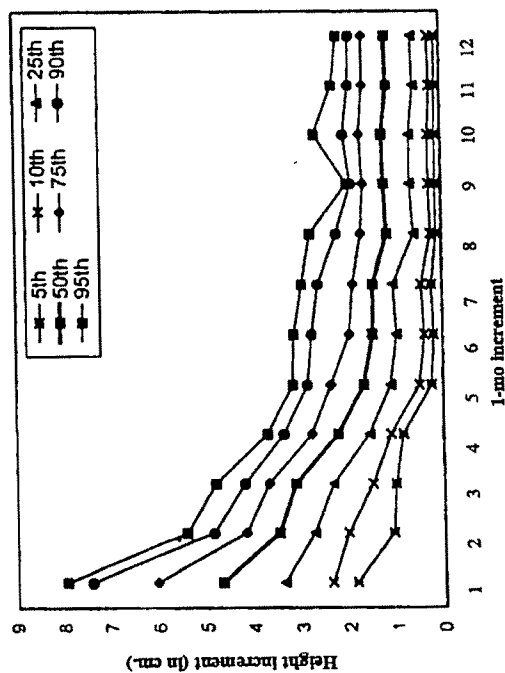


Fig. 3 Percentiles for 1-Monthly increments of Height (cm.) of Punjabi Male Infants

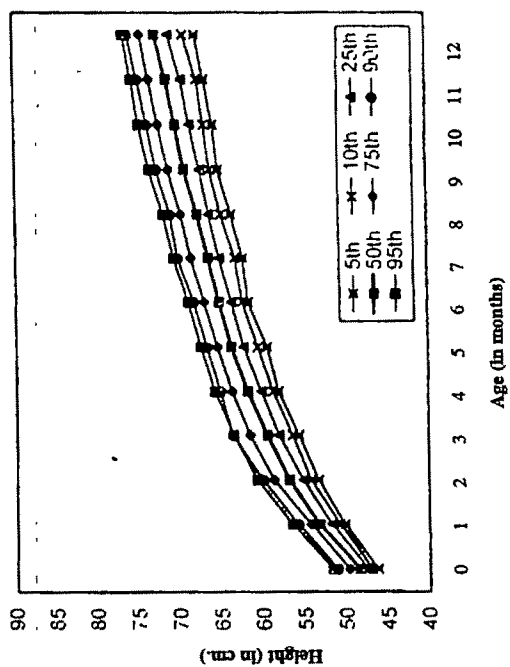


Fig. 2 Height-for-Age Percentiles of Punjabi Female Infants

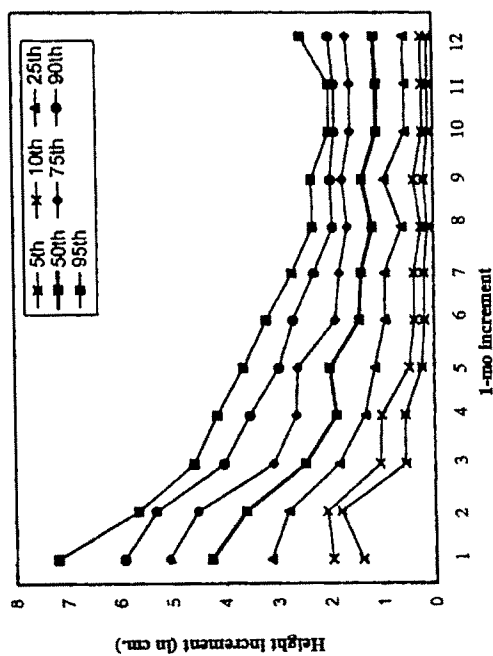


Fig. 4 Percentiles for 1-Monthly increments of Height (cm.) of Punjabi Female Infants

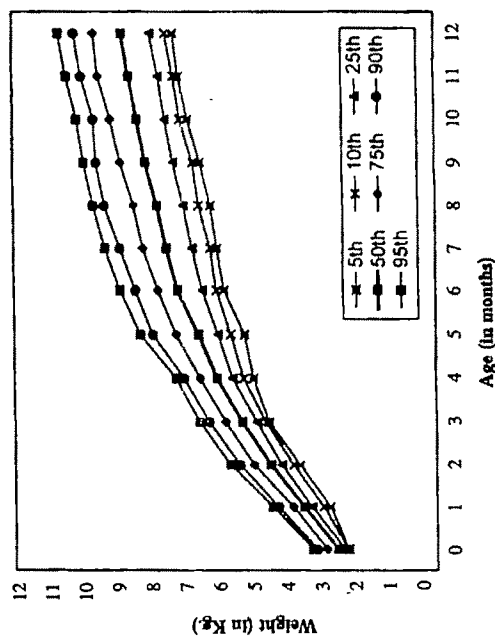


Fig. 5 Weight-for-Age Percentiles of Punjabi Male Infants

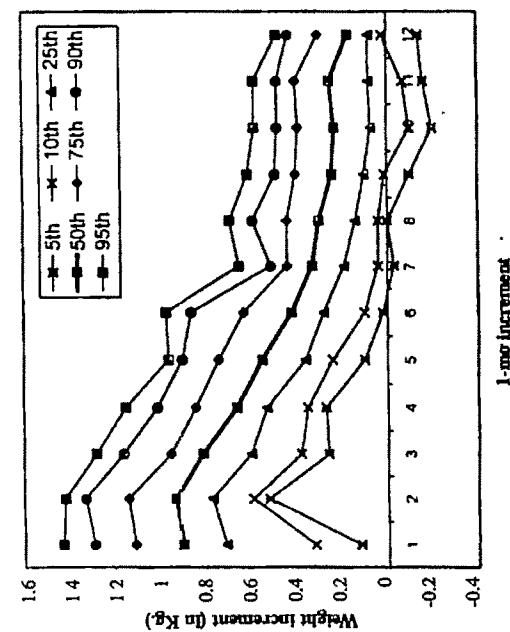


Fig. 7 Percentiles for 1-Monthly increments of Weight (kg.) of Punjabi Female Infants

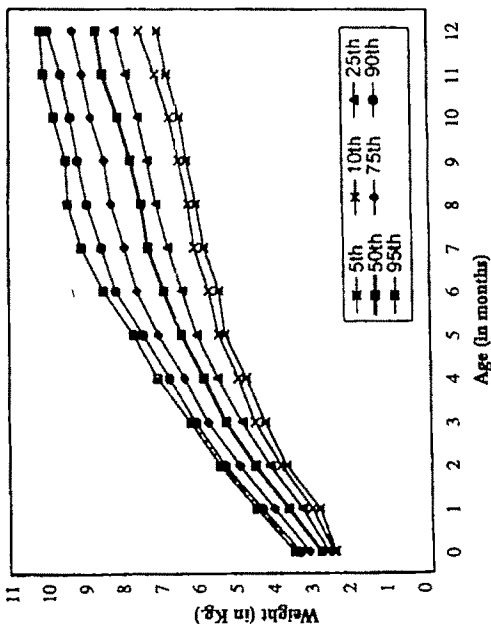


Fig. 6 Weight-for-Age Percentiles of Punjabi Female Infants

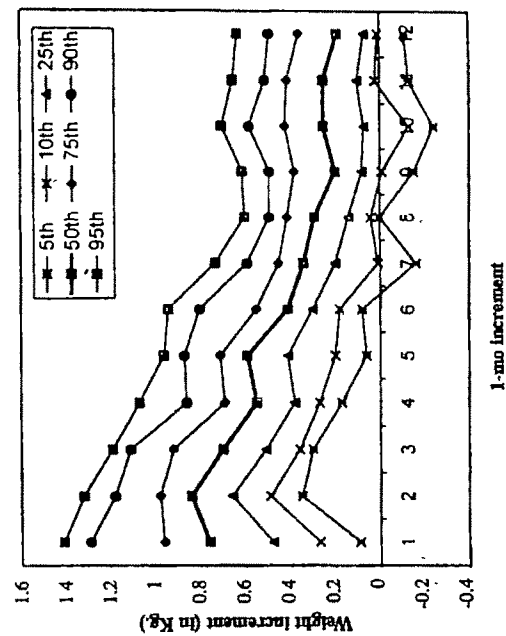


Fig. 8 Percentiles for 1-Monthly increments of Weight (kg.) of Punjabi Female Infants

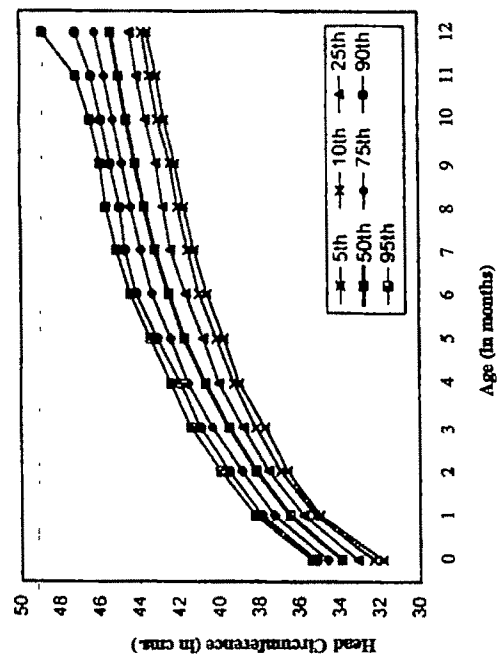


Fig. 9 Head Circumference-for-Age Percentiles of Punjabi Male Infants

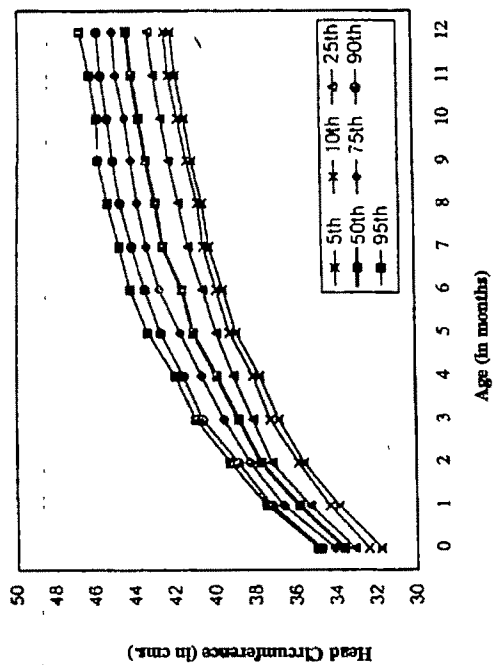


Fig. 10 Head Circumference-for-Age Percentiles of Punjabi Female Infants

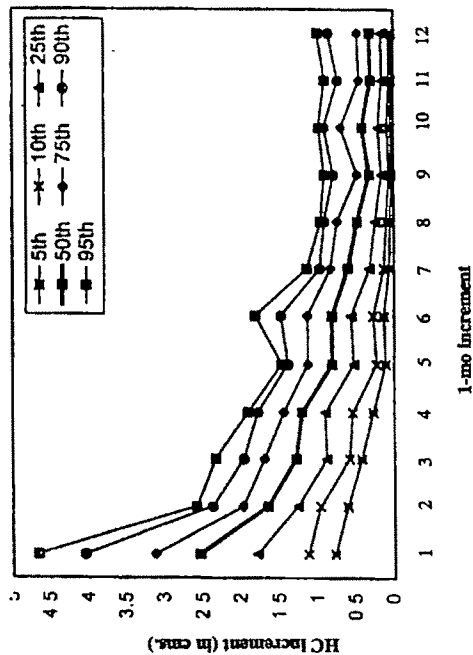


Fig. 11 Percentiles for 1-Monthly increments of Head circumference (cm.) of Punjabi Male Infants

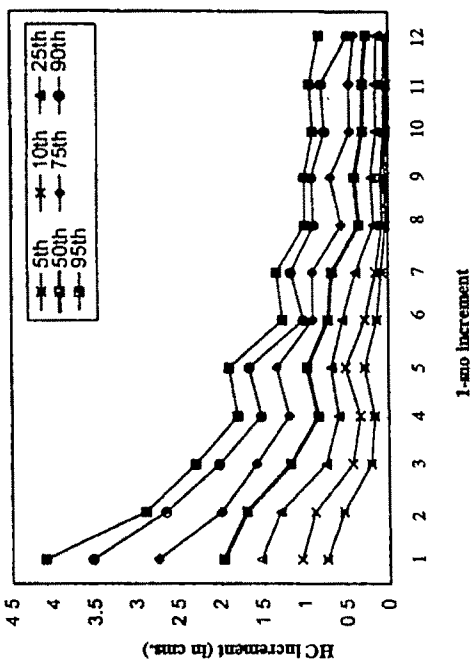


Fig. 12 Percentiles for 1-Monthly increments of Head circumference (cm.) of Punjabi Female Infants

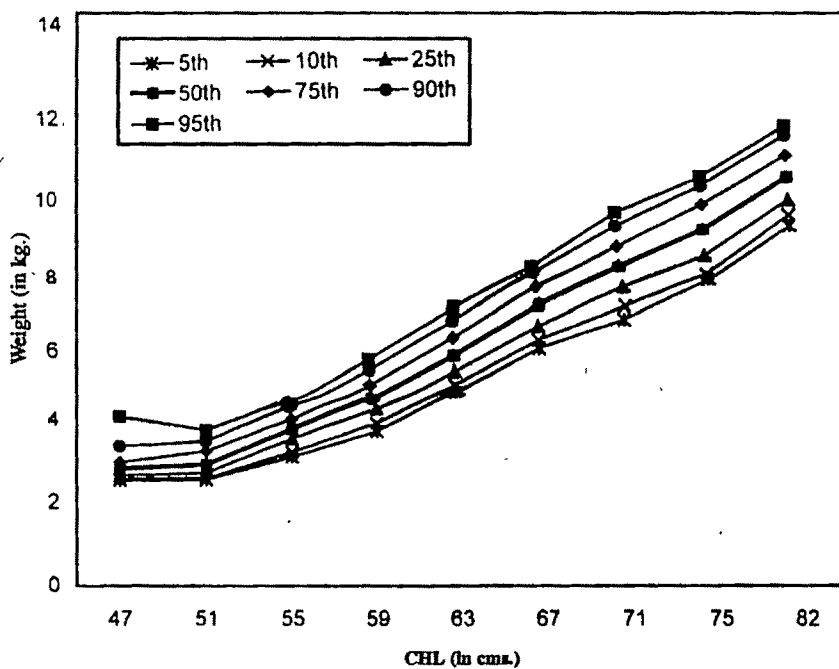


Fig. 13 Percentiles of Weight-for-CHL of Punjabi male infants.

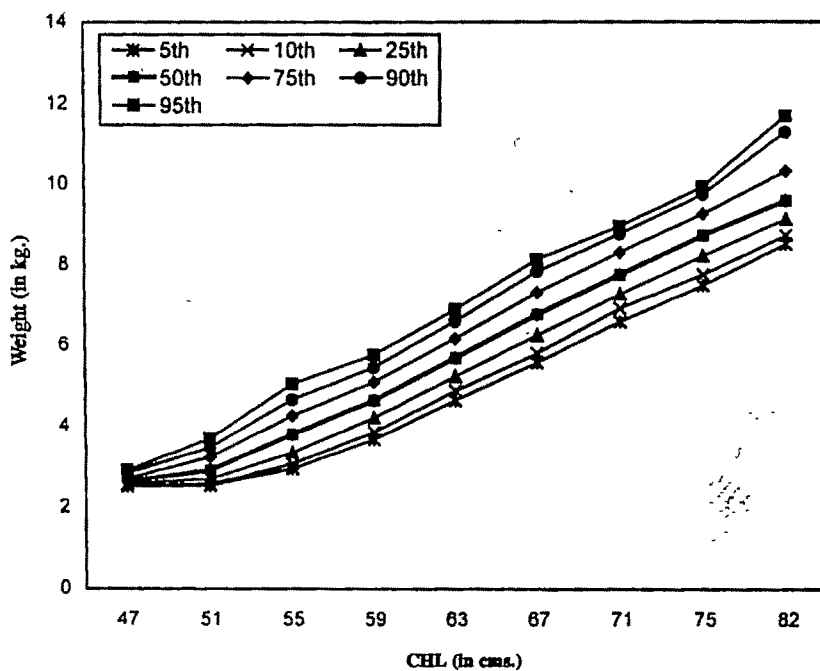


Fig. 14 Percentiles of Weight-for-CHL of Punjabi female infants

A preliminary study on correlation between some of the anthropometric traits and hormone levels in fertile Bengalee Hindu Females of Kolkata

ARPITA MANDAL² AND A.B. DAS CHAUDHURI^{1*}

Abstract : Correlation between sex hormone levels and body dimensions were investigated in a group of fertile women (n=50) of Kolkata, West Bengal. Twenty-four anthropometric traits were correlated with three sex hormones namely-Oestradiol (E2), Lutenizing hormone (LH) and Follicle Stimulating hormone (FSH). Statistically significant correlation could be observed between the three sex hormone concentrations and 24 anthropometric traits. These fertile women showed positive correlation between most of the breadth and/or circumference measures and E2, FSH and LH.

Key words : correlation; anthropometric traits and hormone levels; fertile Bengalee females.

Introduction :

The importance of hormones for somatic characteristics have been well established for many years (Ganong, 1979). While most of the earlier findings were on the proper functions of Growth hormones and thyroid gland hormone, the influence of sex hormones on bone and muscle development and expression of extra-genital sexual dimorphism are recent findings (Tonna 1973; Tanner, Whitehouse, Hughes and Carter 1976; Kuhlmann and Straub 1986; and Tausk Thijssen and van Wimersma Greidanus 1986).

From literature it is found that correlations between several anthropometric characters and sex-hormone levels have been examined mostly on male probands (Katz et al. 1985, Knussmann et al. 1986, Christiansen and Winkler 1990, Winkler and Christiansen 1991). Male individuals are especially suited for such studies since drastic changes in hormone levels as result of cycle or age are not to be expected.

However, similar studies on females are comparatively recent. Correlations between body measurements and hormone were examined with regard to hormonal contraceptives (Schade 1970; and Krause and Stamm 1970), on long distance runners (Raschka 1988; and Schroder 1990). A few studies describe the interactions between androgen levels and overweight (Feher 1975; Tatum and Mayes 1981, Katz, Zemel and Parks 1986). Until recently, the only anthropometric traits to have been considered are the relationship between sex-hormone levels and body weight (Campagnoli 1981; Poortman and Halewijn 1982; and Evans et al. 1983). Focuses on the relationship between body shape and sex-hormone levels in women were pioneered by Kirchengast (1992a, 1992b, 1993).

In context of India no such works have been investigated in any of the Indian populations as revealed by Medline Search (1990-2002).

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Materials and Methods :

a) Subjects : The probands (n=50) comprised of women between the ages 20 to 40 ($\bar{x}$ =32.25 yrs), who were fertile with regular cycles. All probands were healthy, had intact ovaries, uterus and adrenals and a history of normal menstrual cycle. None was on any hormone therapy, hormonal contraception or other medication. All probands were Bengalees, residing in Kolkata belonging to the Hindu caste.

To maintain the similar economic status the probands were chosen from the same MIG Housing Complex of KALINDI, in North Kolkata.

b) Hormone assay : Blood samples were collected between 8 am to 9 am from the probands on the 8th day of cycle i.e. during the follicle phase before ovulation. None of the women under study was pregnant or had undergone any severe gynecological operation.

Assay of LH and FSH were made by Enzymimmunassay (Boehringer Mannheim Enzymun) and E2 was assayed by Radioimmunassay (Coat-a-Coat DPC).

c) Anthropometric variables : From each proband 24 postcephal measures were taken according to Knussmann(1988).

Stature [ST], acromial height [AHT], dactylion height [DHT], arm span [AMS], sitting height [SHT], biacromial diameter [BAD], chest breadth [CB], biillac diameter [BID], bicondylar humerus [BH], chest girth, [CG] waist girth [WG], hip girth [HG], upper arm circumference [relaxed] [UACR], upper arm circumference [flexed] [UACF], wrist circumference [WRC], thigh circumference [THC], body weight [WT], triceps skinfold [TRISF], biceps skinfold [BICSF], subscapular skinfold [SUBSF], supra-iliac skinfold [SPLSF], anterior thigh skinfold [ATHSF], medial calf skinfold [MCASF].

d) Statistical analyses : Statistical evaluation of the data was carried out using Microsoft Excel 2000.

Result and Discussion : The mean and standard deviation of the anthropometric variables and hormones are shown in table1. Sex-hormones influence the expression of the morphological traits. Since growth processes in gneral are multifactorially conditioned, medium or low correlations between hormone concentrations are shown in table 1.

Correlations between hormone levels and anthropometric traits showed that gonadotrophins (LH and FSH) correlated positively with postcephal breadth and circumference measures. Oestradiol (E2) showed positive correlations with the chest and hip girth measurements and the skinfold measurements of the thigh and waist.

Although results show postive correlations between the above mentioned variables and hormones, Pearson correlation coefficient did not reveal significant correlation among them. High significant values at 5% level was found in the correlation with Oestradiol and Body weight.

Women are subjected to dramatic hormonal changes with increasing age and decisive morphogenetic changes have already taken place from and during adolescence. The individual results of this study is difficult to interpret, since the mode of action of hormones on the expression of morphological traits is still not clear.

As mentioned earlier, the relatively low correlation coefficients are to be expected, since growth and development as well as the expression or morphologic traits are

multifactorially conditioned and sex-hormones represent only one causal factor among others (Knussmann et al. 1986).

Regarding the results in detail, it would seem that gonadotrophins, oestradiol exclusively show positive correlations with breadth and circumference measures. This is clearly expressed in the correlation between metric traits and hormone.

This also describes the fat distribution of women and estrogens, gonadotrophins and prolactin (Kirchengast, 1993). More corpulent women with higher circumference and breadth measures produce more oestrogen during the menopause than very slender women. (Kirchengast, 1992b; Kirschner et al. 1982). Thus the feedback mechanism between oestrogen concentration and gonadotrophin secretion is not as drastically affected, so that higher circumference measures correlated with a lower gonadotrophin concentration.

The findings are in concurrence with the results of Kirschner et al. (1982) and Kirchengast (1993). Further works with more data including control are to be treated with advanced statistical analysis to know the facts clearly.

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Table 1 : Mean and standard deviation (SD) of anthropometric variables and hormones among the fertile Bengalee Hindu females of Kolkata.

ANTHROPOMETRIC VARIABLES	MEAN	SD
Stature (ST) [cm]	153.39	4.73
Acromial height (AHT) [cm]	125.98	4.11
Dactylion height (DHT) [cm]	58.56	3.48
Arm Span (AMS) [cm]	158.06	5.27
Sitting Height (SHT) [cm]	81.81	4.03
Biacromial Diameter (BAD) [cm]	35.28	1.61
Chest Breadth (CB) [cm]	28.53	3.03
Biillac Diameter (BID)	28.71	2.11
Bicondylar Femur (BF) [cm]	8.26	0.41
Bicondylar Humerus (BH) [cm]	6.35	0.61
Chest Girth (CG) [cm]	92.82	9.67
Waist Girth (WG) [cm]	85.45	6.63
Hip Girth (HG) [cm]	93.7	12.69
Upper Arm Circumference (Relaxed) (UACR) [cm]	29.13	3.75
Upper Arm Circumference (Flexed) (UACF) [cm]	28.66	2.9
Wrist Circumference (WRC) [cm]	14.84	1.36
Thigh Circumference (THC) [cm]	47.31	5.46
Body Weight (WT) [kg]	60.20	6.88
Triceps Skinfold (TRISF) [mm]	22.65	6.05
Biceps Skinfold (BICSF) [mm]	4.92	1.17
Subscapular Skinfold (SUBSF) [mm]	18.84	5.02
Supra-Iliac Skinfold (SPLSF) [mm]	18.14	4.38
Anterior Thigh Skinfold (ATHSF) [mm]	24.53	6.64
Medial Calf Skinfold (MCASF) [mm]	15.54	3.27
HORMONES	MEAN	SD
Luteinizing hormone (LH) [MIE/ml]	10.42	2.05
Follicle stimulating hormone (FSH) [MIE/ml]	5.7	1.48
Oestradiol (E2) [Pg/ml]	71.67	7.92

Table 2 : Pearson correlation coefficient (r) of anthropometric variables with hormones among the fertile Bengalee Hindu females of Kolkata.

ANTHROPOMETRIC VARIABLES	rLH	rFSH	rE2
ST	-0.55**	0.07	0.05
AHT	-0.27*	0.112	0.10
DHT	-0.19	0.33*	-0.01
AMS	-0.13	0.05	0.07
SHT	-0.21	0.25	0.04
BAD	-0.16	0.30*	0.07
CB	-0.21	0.15	0.08
BID	-0.25	0.14	-0.15
BF	-0.18	0.05	0.03
BH	-0.10	0.16	0.13
CG	-0.05	0.10	0.16
WC	0.04	0.18	0.09
HC	0.07	0.18	0.05
UACR	-0.06	0.15	0.18
UACF	-0.17	0.16	-0.0003
WRC	-0.18	0.20	0.001
THC	-0.23	0.13	0.05
WT	-0.03	0.30*	0.4
TRISF	-0.1	0.16	-0.09
BICSF	-0.16	-0.04	-0.08
SUBSF	0.16	0.12	0.0003
SPLSF	-0.11	-0.14	-0.02
ATHSF	-0.17	-0.06	-0.03
MCASF	-0.02	0.15	0.18

* P < 0.05, ** 0.01

A study of mother health-care of some Bathudi women from Simlipal area, Orissa

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Abstract : The present paper is based on the study of the Bathudi tribe of Simlipal reserve forest area, Mayurbhanj district, Orissa. The study focuses on the health condition of the women who are pregnant and at post delivery condition. The objective of the study is to ascertain the extent to which the community members are aware of the modern medical facilities. Data were collected with the help of interview schedule, both open and close ended. Special emphasis was laid on case history for in-depth enquiries. On an average Bathudi females get married around 18 years of their age. Most of the Bathudis become mothers at the age of 21 years. Average number of pregnancies per mother among the Bathudi is 4.02. Birth wastage has been 4.5 percent among the Bathudi mothers. Overall health status of Bathudi mothers reflects lack of proper nutrition. Traditional food taboo during ante, intra and postnatal period has got important bearing on nutrition. Modern health care is inadequate.

Key words : Bathudi, mother- care, food taboo, nutrition.

Introduction :

Existence of man in the Indian subcontinent can be traced as far back as two million years (Dennel, 1998). Man has survived through this vast span of time. There are situations in time and space when man lived without the help of modern health care services. People have got indigenous method of mother and childcare. Mother hood is an important aspect of survival. The authors have taken up a project among a group of tribals living in somewhat isolated situation in the Simlipal reserve forest area, district Mayurbhanj, Orissa.

There is no appropriate definition of tribals, not even in the constitution of India, although a number of scholars have provided definition for the tribe. In India tribe is more an administrative term (Singh, 1964). A tribe may be considered as a territorial group, who speaks a common language of their own and / or the language of their neighbours. Kinship operates as a strong associative (Yadav, 2000). According to Sahlins (1968) economy of tribal people is marked by small-scale production, restrictive division of labour, underdeveloped transport and communication and low productivity . British policy was to keep the tribals isolated from the main stream. Post independent India-government is making all effort to bring the tribals out of isolation and for the development of the lot. Bathudi belongs to the Scheduled tribe category under the constitution of India.

Main purpose of the work is to find out health care services among such relatively isolated group of people. There are two objectives. One, is to provide information for the developmental activities; the other is to get some idea about the health care practices, which might have been present in remote past under similar situation. So far no work has been done on mother care among the tribals of eastern India. This work is a part of the project

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for the Departmental Special Assistance programme sanctioned by UGC. Initially work was done between two tribes in Simlipal area, the Kharia (Ray *et al*, 1999) and the Bathudi. The former depended more on forest product for their livelihood and lived within the tiger project area of the reserve forest. The Bathudis are a settled agriculturist group, living along the periphery of the reserve forest. In this paper nature of mother care among some Bathudi women is presented. Mother care may be divided into phases like antenatal, intranatal and postnatal (Park, 1997).

In India, the average pregnant mothers suffer from anaemia, malnutrition and other forms of maternal depletion syndromes. During the childbearing age, a woman passes through a series of cycles of pregnancy, prolonged lactation and consequent pregnancy, without any rest in between the successive childbirths. All this time, poor diet supplies her only with marginal nutrition.

The Tribe Bathudi

The Bathudis are mainly found in Orissa and Bihar. In Orissa their main concentration is in Mayurbhanj and Keonjhar districts (Singh, 1994). According to the 1991 Census, population in the District Mayurbhanj was 15.8 lakhs. Out of these 9.12 lakhs were scheduled tribes. Bathudis make up 0.82 lakhs. Bathudi claims that they migrated from Bakua in the Simlipal hills. The probable homeland of Bathudis is the Panchpir and Sadar Subdivisions of Mayurbhanj district. From there, they migrated to Keonjhar in Orissa. The Bathudis are short-statured, delichocephalic, with a medium nose and a broad facial form (Singh, 1986). They speak a dialect of Oriya. The Bathudis are mostly marginal farmers who also work as labourers for contractors in forest, on road and in irrigation projects. Earlier they practised swidden method cultivation, which is discontinued since the last century. Bathudis practise endogamous marriage. They have clan exogamy. At present they have adult marriage but earlier child marriage was practised. Marriage is usually arranged by negotiation. Polygamy is allowed. Divorce is allowed with the permission of the village council. Bathudis are basically agriculturists. Some are landowners. Rice is their staple food. They also take termites and red ants. They take the services of Hindu Brahmins, barbers and washermen. They worship Hindu gods. They either cremate or bury their dead.

Methodology

For the present study a number of methods were used. The authors adapted standard anthropological field techniques (Pelto, 1970). These were both verbal and non-verbal. Both structured and unstructured schedules for interview were framed. Data were collected on important topics relevant to the present study. These were based on age at marriage, age-specific fertility study, age at first childbirth, distribution of pregnant and lactating mothers, anthropometric measurements of mother, diet survey and immunization of mothers during antenatal period. For diet survey the interview and objective methods of weighment were followed (Aykroyd and Krishnan, 1937; Weiner and Lourie, 1981). Calculation is made on intake in terms of per consumption unit per person per day. The actual intake is compared against actual requirement. Assessment of food requirement of women was done on the basis of National Research Council Recommendations of Daily Dietary Allowances Chart,

produced by Food and Nutrition Board (Gopalan and Rao, 1980). Standardized cups, bowls and spoons were used at the time of weighing for easy estimation of raw food stuffs, both solid and liquid.

Villages and the people

The field investigations were carried out in the four villages of Simlipal Reserve Forest Area within Panchir Subdivision of Mayurbhanj District of Orissa. They are, Borsiaronoi, Kurkutia, Sansiaronoi and Bonkati. The village Borsiaronoi is further divided into two localities or *Sahis*, known as, Borsiaronoi *Sahi* 1 and Borsiaronoi *Sahi* 2. Except the village Bonkati, which is situated within Bisoi block, the rest of the villages are under the block of Joshipur. The villages are surrounded by Simlipal Reserve Forest. The land is forested and undulating in nature. It generally rises and merges into the Simlipal range. Most of the trees are northern tropical semi evergreen species, such as, *Sal*, *Sisu*, *Kendu*, *Mahua*, *Kusum*, *Mango*, *Piasal* etc. Tributaries of river Bhondon flow close to the villages. The Simlipal range forms the backdrop for all the villages. Borsiaronoi *Sahi*-1 is about 12 km away from Joshipur township, situated on the eastern bank of the river Bhodon. Borsiaronoi *Sahi*-2 is situated 4 kms to the Western side of the village Borsiaronoi *Sahi* -1 and is 16 kms away from Joshipur township. Kurkutia is situated on the eastern bank of river Bhondon and is adjacent to Borsiaronoi *Sahi*-1 and is at a distance of 14 km. from Joshipur town. Sansiaronoi *Sahi* is a dispersed type of village, situated within the reserve forest area. The altitude of this village is much higher than the other ones. Joshipur township is about 18 km away. A river dam is present next to this village. Bonkati *Sahi* is situated on the bank of the river Bhondon. Joshipur town is about 22 km away. A number of streams of the river Bhondon are flowing near this village.

The villages are of mono ethnic type. Twenty Bathudi families reside In Borsiaronoi *Sahi*-1. The total Bathudi population of this village is 113. Out of this, the male population is 49 (43.36%) whereas female population is 64 (56.64%). Six Bathudi families live in Borsiaronoi *Sahi*-2. The total population is 24, out of which 13 are male members and 11 are female members. Six Bathudi families reside at Sansiaronoi village. The total population of this village is 34. The male and female population is 15 and 19 respectively. Eight Bathudi families inhabit Kurkutia Village. Total population of this village is 37 out of which 14 are male and 23 are female. Sixteen Bathudi families are the inhabitants of Bonkati village. Total population is 98, 46 are male and 52 are female. The total population of the sample villages is 306. Out of these, male is 137 and female 169. The age-sex wise distribution of Bathudi population in the Sample villages shows that the female members are more in number than male members except in Borsiaronoi *Sahi*-2.

Facilities in Villages

The availability of health services in the localities are grossly inadequate and are located far away from the villages. There are two hospitals. One is situated at Joshipur and the other is at Monda within Bisoi block. Joshipur hospital is approximately 15 km to 16 km away from the villages. Villagers of Bonkati occasionally go to Monda Hospital, which is 9 kms away. People need to travel to access the health care services, which inflates the opportunity cost. Under the Integrated Child Development Scheme, the Government of India

has created some good health care centres in this locality. Such centres are known as *Anganbaris* and are located within one kilometer from the villages Bonkati and Kurkutia. The Public Health Centres (PHC) are situated within 4 km from the sample villages. Essential medicines are not always available in local PHC. The main purpose of *Anganbari* is to provide basic health care facilities to the local mothers and children. Non-formal education, immunization and nutrition are given to the mothers, both pregnant and lactating and to children up to 6 years of age. The women remain busy either with their household jobs or are engaged in subsistence activities like agricultural operations or collection of forest products. In the process they usually miss the cooked food. In most cases, due to non-availability of the vaccines, the mothers are not immunized on time. Most of the villagers go to the local traditional health practitioners (Herbal Medicine man) who reside near the village Kurkutia. In case of complicated diseases, the villagers go to the hospitals at Joshipur or at Monda.

The Bathudis of Borsiaranoi and Kurkutia get water from deep tubewell, which they use mostly for drinking. Other personal and household works are done with the stream and river water. The villagers of Sansiaranoi and Bonkati use stream and river water for drinking. Same source of water is used both for bathing and washing clothes and utensils.

Two primary schools are situated near the villages Kurkutia and Bonkati. For secondary education one has to go either to Joshipur or to Monda townships. It is not possible for girls to attend school regularly because they have to take care of their younger brothers and sisters when their mothers go for outdoor jobs. The eight or nine year old girls stay at home and help their mothers in household jobs. Literacy rate is very low among the females.

Subsistence pattern and economy

Most of the Bathudis in present study are engaged in agriculture excepting those from the village Sansiaranoi, who are landless and depend upon daily wage labour and collection of forest products for living. Both male and female members take part in the subsistence activities. They work as daily labourers in other people's field, and/or in their own agricultural fields, or collect forest products. Out of the fifty families, seven of them have some land holding. They have approximately 3 to 4 kathas of land each, where they cultivate rice and rabi crops. Twenty-eight families are sharecropper and collectors, six families live as agricultural labourers. There are a number of people who have mixed subsistence pattern. Four such families live on cultivation, collection of forest products and daily labour. Four families have service holders as well as cultivators. Members of one family combined service as occupation with collection of forest products and cultivation. Services done are at local educational institutions, local PHC and at Post Office. The male members of the family take up service.

Many women work in the fields. Some women are found working at a very advanced stage of pregnancy. Lactating mothers also go to the fields for agricultural jobs. They work for 4 to 5 hours from 10 am to 5 pm. They get recess for lunch in the afternoon at about 1'0 clock to 3'0 clock. Agricultural operations carried out by women are weeding, harvesting, husking, winnowing and storing of the grains. Weeding and harvesting of sheaves are done before lunch break. The rest of the work is done after midday meal. They get their wages

in cash at the end of the day. Payment depends upon the workload. Approximately the daily wages for females are Rs. 10/- to Rs. 15/- and for males Rs. 10/- to Rs. 20/-. During the idle season of agriculture they collect forest products.

One of the secondary occupations of the Bathudis is collection of forest products. This is usually carried out during the summer months, when other jobs are not available. Both male and female members collect forest products and sell them in the local market at a very low cost. *Shal* leaves, *Mahul* kernels, edible tubers, honey, wax, wild fruits, edible herbs and gum are the items collected. Literacy rate is very low among Bathudis. Therefore, scholars took great care about collection of the monthly income from Bathudi families with minimum error. The cost of each consumed food item is also gathered together with the income of each family.

The average monthly income of the Bathudis under present study ranged from RS. 350/- to Rs. 1500/- per family per month. Only seven families have monthly income above 1500/- to 2000/- and one family earn above Rs. 2000/- per month. People with higher income are engaged both in cultivation and in service sector.

Women of the village

Age at marriage

It is found in the present study that Bathudi women are married, between the ages of 15 to 30 years. Average age for marriage in the villages studied was 18 years. No unmarried women were found after 25 years age and no one was married below 13 years of age. In the present case only two girls were married at 13 years of age. No one became mother below 15 years of age. Maximum marriages took place within the age group 21 to 25 years.

Health status studies among Bathudi Mothers

A health study was conducted on the basis of anthropometric measurements on mothers. Parameters taken for these studies were height, weight, mid upper arm circumference and skin fold thickness. These anthropometric measurements were objective methods of nutritional assessment.

Table showing anthropometric measurements of the 56 mothers of five villages.

Height (cm)	Weight (kg)	Mid upper arm circumference (cm)	Triceps skinfold (mm)
Mean = 145.74	Mean = 43.84	Mean = 23.1	Mean = 6.66
S.D. = $\pm$ 8.269	S.D. $\pm$ 3.977	S.D. $\pm$ 1.45	S.D. $\pm$ 0.865
Range 97.6-158.0	Range 34.4-52.0	Range 19.8-29.3	Range 5.0-8.9

A total number of 56 women were measured. The study was made on mothers including pregnant and lactating mothers. The mean height was 145.76 cm. One woman was 97.6 cm. Rest of the women had more or less similar height, which varied between 144 cm to 158 cm. The weight is taken in kilogram. Mean weight was 43.84 Kg. Weight ranged between 34.4 -52 kg. The mid arm circumference showed a mean value of 23.1 cm. Range was 19.8 -29.3 cm. Mean tricep skin fold was 6.66 mm, range being 5 -8.9 mm. Ideal

weight for Indian female for 146 cm height is 48 kg (Mahdevan 1986 : 326). The present study group has shown slightly lower value. Bathudi mothers in this work may be considered as of short stature (Singh, 1994: 94) and lean. Although they are not well nourished, they are not severely undernourished.

Immunisation of Bathudi Mothers

Expanded programme of immunization (EPI) has failed to cover successfully in this area. One of the reasons for failure of this programme is that the visits of health staffs in the villages are irregular. Secondly, the women of the villages hardly have time to visit the centres at the stipulated time because they were either busy in subsistence activities or engaged in household chores. Incomplete immunization of the pregnant mothers is a very common feature in this locality. The study shows that the distribution of Folifer tablets (iron tablets) among the mothers is very irregular. Out of 56 mothers, only 9 mothers have taken iron tablets regularly from first trimester (each packet contains 60 tablets), 26 mothers did not complete their medicinal doses. Most of them have taken only two to three packets of iron tablets and later they had completely stopped taking the tablets. 21 mothers did not take any packet at all during pregnancy.

Every mother should be given at least 2 doses of tetanus toxoid at one month's interval to protect against maternal and neonatal tetanus. Unfortunately acceptance of this vaccine is still very low among the Bathudi mothers. Out of 56 mothers, 38 have taken only single dose of T. T. vaccine and 18 mothers were not immunized at all. Neither health workers nor mothers were concerned with the completion of the immunization.

Food for Women

Nutrients can be divided into three categories according to their function. They are energy giving nutrient, body building nutrient and protective nutrient (Jelliffe and Jelliffe, 1972).

In all five villages, rice is the staple food. They take wheat bread (*Chapati*) only when they are sick. Practically no food taboo exists among the people except for expectant and new mothers. Usually upto about six months after childbirth women are not allowed to eat certain food. These are non-leafy vegetables; sour fruits like tamarind; the hog palm; pulses like biridal; flesh food like meat, fish and egg. Bathudi lactating mothers believe that the baby would suffer from stomach trouble if they consumed the abovementioned food. Recommended diet for such mothers are boiled rice with pinch of salt and few non- tabooed boiled leafy vegetables. Women are allowed to take the fore-mentioned tabooed foods, only when the baby is given substitute for breast milk. At antenatal period she avoids eating sugar, jaggery, jackfruits, ripe mango, sweet potato and eggs. The belief is that these foods may cause wastage of pregnancy. They eat less to produce a small foetus for easy labour during parturition. Pregnant mothers of Bathudi believe that the milk is food for the calf and if a pregnant mother takes milk she will be cursed by God and her baby will die in her womb. Similarly the egg is future bird.

It appears that diet of Bathudi mothers is highly deficient in nutrients necessary for a pregnant mother. The food intake per day in each trimester of pregnant women was collected by weighment method. The weights of edible foods in raw state were used for weighment.

Table showing intake of different foods per day by the pregnant women in first, second and third trimester.

Food Stuff (Grams)	RDA by ICMR gms	Mean values of food intake (gms) by the pregnant women in different trimester.		
		I	II	III
Cereals (Rice)	475	220	230	230
Pulses	60	12	15	15
Roots and Tubers	50	55	60	60
Leafy Vegetables	100	30	39	45
Other vegetables	40	20	26	28
Fats and Oils	25	5	5	5
Sugar and Jaggery	30	—	—	—
Milk and Milk Products	250	—	—	—
Fruits / Honey	30	—	—	—
Meat / Fish / Egg	30	—	—	—

Consumption of cereals, pulses, leafy vegetables, fats and oils, sugar and jaggery, fruits, milk and milk products by the pregnant women in three trimesters were less than the values of Recommended dietary allowances (RDA) of ICMR. The pregnant mothers do not take milk products, meat/fish; egg nor fruits in antenatal state.

Recommended diet during postnatal period indicates that lactating mothers neither take any protein diet nor consume cereals and vegetables sufficiently. Mothers consume only sweet tasted fruits but sour tasted fruits are completely avoided by them.

Table showing food intake values of the lactating mothers

Food Stuff (Grams)	RDA by ICMR gms	Mean values of food intake (gms) by the lactating women in postnatal period
Cereals (Rice)	400	250
Pulse	55	15
Green Leafy Vegetables	150	40
Green Vegetables	125	32
Meat / Fish / Egg	60	—
Fruit / Honey	30	15
Milk Products / Milk	225	—
Sugar / Jaggery	50	20
Oil / Fats	50	5

Food preparation and cooking methods

Water soaked pre cooked rice with a pinch of salt is regularly eaten by them in the morning. In the daytime, mothers consume gruel and rice. In the evening they take boiled rice without starch. Pulses are cooked by boiling as is usually done in India. Salt, dried chillies, turmeric and onions are added to pulses while cooked. Leafy vegetables are mostly eaten after frying it with little edible oil and pinch of salt and green chillies. Green vegetables after they are meticulously skinned are cut into pieces and boiled with adequate salt, chillies and if available with oil. Turmeric and onions are added to boiled vegetables for taste. Oil and fat consumption is very low among them. Mustard oil is costly and is sparingly used. Oil, made from the seeds of Mahua fruits, is mainly used in cooking. The oil is pressed at home. Other kinds of cooking oil are from Kusum and gingelly seeds. Very small amount of spices are used in all item of cooked foods. The most common spices used by them are turmeric, cumin, coriander and dried chillies. Honey is used as medicine, especially for cough and cold.

Child Birth

Place of delivery for 99% women is at home. At the time of delivery, traditional midwife attends mother. Most of the pregnant mothers continue with their normal life and work until the labour pain is felt. At parturition the woman goes into that part of the room kept as a lying place. A near relative or an older woman acts as midwife of the village. A blade or a razor or a broken piece of glass or a bamboo sliver cuts off the umbilical chord. A hole is dug in the courtyard or in one corner of the room, after birth and the chord is planted in the hole. The health workers of *Anganwari* are provided with a delivery kit consisting of safety razor, a piece of gauge and an antiseptic lotion for the naval chord. Only the midwives of Bonkati and Kurkutia use this kit. Midwives of other villages smeared the chord stump with boiled ghee as an antiseptic measure.

Fertility condition of woman

In order to understand the fertility condition data were collected on the number of live birth, still birth and death at infancy. 56 mothers are present in the villages. It was found that total number of live births were 137, still births were 9 and death at infancy due to diseases were 15. Birth spacing between the children was mostly 1 year to 2 years. Such a narrow range of birth spacing is extremely hazardous for the health of the tribal mothers.

Health Care

Usually no special health care is given to the pregnant mothers. They do all types of household works and outdoor jobs, even upto third trimester of pregnancy. Mothers carry firewood from jungle, fetch water from stream or river, and engage themselves as labourers and in agricultural jobs. Although health care centres provide nutritive food to them but expectant and nursing mothers hardly have time to visit the centre at the stipulated time. The pregnant women take no extra foodstuffs. Most of the women are incompletely immunized by the T. T. vaccines. Health staffs irregularly visit the villages, so they do not get oral medicine regularly.

Lactating mothers also engage themselves in all sorts of household jobs after 21 days of childbirth. They start to do outdoor jobs after six months. Sometimes the child is taken to its mother by other women to the agricultural field for breast feeding. Food intake is not sufficient for the nursing mother. As a whole, poor health condition is a common feature of these tribal women. Antenatal and post natal care are not satisfactory because mothers are deprived from all kinds of health care facilities. The traditional prohibition on certain food stuff also causes deficiency.

Conclusion

The study is made on health care system of Bathudi mothers of Simlipal Reserve Forest Area, Mayurbhanj District of Orissa. Number of people studied are 306. Out of which 56 are mothers. Prenatal care, safe delivery and postpartum care can have a significant impact on the health of women and their newborn babies. Immunization, micronutrient supplementation, counselling, the detection and prompt referral and treatment of obstetric complications are necessary. Study shows that all the above-mentioned facilities are highly inadequate among the Bathudi mothers. It has been observed that limited subsistence strategy, poor economic condition, illiteracy, biological, social and cultural factors are highly affecting the health conditions of women under study. Although women were not severely undernourished, they were not well nourished either. Mother care is still in the indigenous level. Dependence is still largely on nature and traditional system.

Social and cultural factors include early age at marriage, traditional delivery system, and food taboos during antenatal and postnatal periods and narrow birth spacing. These are creating hindrances towards a comprehensive development of health status.

Under such a situation compulsory primary education, improved sanitation, preventive health care system and economic upliftment have to be implemented for improving the mother health status in Simlipal Reserve Forest area.

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Family planning practices and pregnancy outcome — A study of the Bengalee Hindu mothers with congenitally malformed babies

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Abstract : Family planning is an adaptive strategy, mainly in Afro-Asian nations where the problem of population explosion is more imminent and family planning has been envisaged as a method of warding off hunger and starvation. However, apathy of the true concept of family planning has often led to insensitivity to problems such as couple-children ratio, mother's health and succeeding pregnancies after adoption of such practices. The present study however confines itself to the family planning practices adopted by Bengalee Hindu mothers with congenitally malformed babies and the sequence and consequence of such adoptive practices. This study also throws light on the pregnancy rate of the mothers with a child with congenital defect.

Key words : Family planning practice, pregnancy rate, index birth.

Introduction

Reproductive health is an indispensable ingredient of health and major determinant of human development. The final document of the International Conference on Population and Development held in Cairo (1994) had urged that all countries should strive to make family planning accessible through the primary health care system. Reproductive health implies that people have the capacity to reproduce and the freedom to decide if, when and how often to do so. Within this broad framework, the legal, social and cultural needs of the society are intertwined, with the right for men and women to have information and access to safe, effective, affordable and acceptable methods to control fertility and health care services for the couple, mother and child. It encompasses a wide diversity of health care needs of the community by recognizing the special needs of women before and after child births, the needs of growing child and the needs of men (Pachouri 1996).

In India and other developing countries, reproductive health needs have been addressed through maternal and child health and family planning programmes. Several studies have demonstrated that though the optimal reproductive age of the mother is between 20 and 30 years, reproductive wastage in the form of abortion, still birth, congenital malformations was quite significant among these group (Coyaji 1996; Roy 1996; Anand Kumar 1996; Verma 1986; WHO 1994). Knowledge of family planning is nearly universal in India with about 96% of married women in the age group of 13-49 reporting knowledge of at least one contraceptive method (ICMR 1990).

Birth of a child with congenital malformation is a traumatic experience for the family. However the decision to have another child after delivering a child with birth defect may be influenced by a variety of biological, psychological, economic and cultural factors. Infant survival, infant growth and development, as well as the severity of the

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birth defect, whether the defect is spontaneously or surgically correctable, and the risk of repeated adverse outcome are thought to be important factors (Blomberg 1980; Polednek and Oski 1976; Carmichael and Shaw 2000; Robert et al 1994; Knudsen and Borlum Kristensen 1998; Basso et al 1999; Olsen and Frische 1993). The desire for a normal replacement child might increase subsequent fertility. On the other hand, the psychological and financial stress of caring for a handicapped child with special needs might decrease subsequent fertility. The determinants of subsequent pregnancies are of interest to families of reproductive age, to clinicians who serve them and to reproductive epidemiologists. Several authors (Davis et al. 1995; Rubin and Ferencz 1985; Record and Armstrong 1975) have studied reproductive outcome after the birth of a child with birth defect.

Though studies on family planning in India have been mainly related to the use of different types of methods across the various states, and their efficacy in controlling or checking the spread of infectious diseases (Roy 1983, 1987, 1991), but the family planning practices among the couples with a malformed child is still sadly lacking.

With the above contentions in mind the present study was undertaken to compare the pregnancy rates of mothers of children with birth defects to those of mothers without birth defects and determine the type of family planning methods adopted by the mothers prior to the birth of the child with defect and during subsequent periods of the birth of the child.

Materials and methods

The data for the present study was drawn from the hospital records of Ramakrishna Mission Seva Pratishthan for the period 1980-2000. Ascertainment of infants born to Bengalee Hindu parents, with birth defects were done at the time of birth and during subsequent period of postnatal check up in the well baby clinic of the same hospital. Control infants were selected from the same birth population and frequency matched to cases on birth year, birth hospital. Data of infant survival, number and timing of all subsequent pregnancies, maternal demographic factors, maternal chronic disease status, history of periconceptional exposures to smoking, vitamin use, alcohol consumption and history of previous pregnancies (any previous completed pregnancy) and fertility problems (failing to become pregnant within first year of trying) were all collected in a detailed schedule specially prepared for the purpose. Periconceptional refers to the 6 month period including the 3 months before pregnancy and the first trimester of the index pregnancy. Two types of pregnancy rates are reported here (Davis et al 1995) — those for pregnancies initiated within 3 years after index births (early pregnancy) and those for pregnancies occurring at any time subsequent to the index births (total pregnancy). Pregnancy rates after index births were examined for each of the three distinct groups of mothers.

Group I — control group mothers (8450) of live born infants without birth defects.

Group II — mothers (345) of live born infants with major birth defects who survived infancy and

Group III — of mothers (1015) whose infants had major birth defects and were either still born or live born but died during infancy.

Statistical analysis based on chi-square was done following standard methods, in Microsoft Excel version 6.0.

Results and discussion

Control mothers and case mothers were similar with regard to many of the demographic and behavioral characteristics as listed in table-1; comparison of the control mothers with each of the case mothers reveals significant difference for some of the characteristics. Differences exist between control and case I mothers in previous complicated pregnancy, chronic disease and planned pregnancy. Control mothers were different from case III mothers with regard to periconceptional employment, previous complicated pregnancy, chronic disease and planned pregnancy. The case mothers and control mothers showed similarity in completed educational level and fertility problem.

Table-2 reveals the pattern of adoption of family planning methods by the mothers/couples before and after the birth of the infant with defect. A significant difference is noted in the behaviour of the couples in the usage of family planning methods indicating an influence of the infant with birth defect on the reproductive behaviour of the couples.

Table-3 and 4 indicates the distribution of family planning practices adopted by the mothers/couples prior to the birth of the infant with birth defect and after the birth of the child. It is evident from the table that there has been a change in the adoption of the family planning practices both among the mothers of singleton infants and twins.

Table 5 shows the proportion of each group of mothers having a subsequent pregnancy at any time following the index birth (total pregnancy) and the proportion of having a pregnancy ending within 3 years of the index birth (early pregnancy). Approximately 76% of the control mothers and 30% of the case mothers had subsequent pregnancies some time following index births. 23% of control mothers and 69% of case mothers had early pregnancy. A close examination further revealed that while 51.88% of the mothers who had infants with birth defects surviving the infancy had early pregnancy but 75.36% mothers whose infants with birth defects did not survive or were still born had an early pregnancy. In contrast mothers who had infants surviving the pregnancy had a higher total pregnancy rate than the mothers whose infants with defect did not survive or were still born.

As evident from the present study the mothers with infant having birth defect were more likely to have early pregnancies than mothers of infants without birth defects. The usage of family planning methods is also an indirect measure indicating the urge of the mothers to replace the lost child as early as possible. The implication of usage of family planning methods is evident in the pregnancy rates of the mothers with infants having birth defects. It is also interesting to note that the mothers whose infants survived the infancy had higher total pregnancy rate than the mothers whose infants did not survive. This might be due to the fact that once the family becomes accustomed to the needs and demands on the emotional, psychological and financial front they plan a pregnancy. On the other hand, mothers whose infants did not survive, have a higher early pregnancy rate as they have to face the emotional stress only and not financial and physical demands, which normally an infant with birth defect imposes on a family.

Studies by several authors, across the world, on pregnancy experience after the delivery of a child with a birth defect reveals diverse picture. Davis (1995) in a population based control study over a period of 12 years (1968-80) in Atlanta, U.S.A. found that mothers of children with birth defects were more likely than control mothers to have a subsequent pregnancy especially during the first three years of index births. Increased pregnancy was also noted after the birth of an infant. Rubin (1985) found that mothers of deceased infants with heart defects had dramatically higher pregnancy rates. However, subsequent pregnancy rates of mother with surviving infants with birth defects were considerably lower than the control mothers. In contrast, Wolff (1970) found that half of the parents who experienced perinatal death of their infants from any cause, wanted another child and half did not. Park (1971) in a data set of Korean reproductive patterns found a shorter birth interval after the death of an infant from any cause, which was attributed to "replacement effect" in a developing country experiencing a decrease in family size. Bjerkedal and Erickson (1978) noted a tendency of mothers to increase their fertility after having infants who die of any cause. Record et al (1975) found that stillbirth and early death of malformed infants in Birmingham, England from 1984-70 were followed by shorter birth intervals. However, Boon (1972) in his study on children with teratology of Fallot, found no statistically significant difference in the subsequent pregnancy rate or in the desire for subsequent pregnancy.

Psychiatrists and other clinicians suggest that mothers whose infants die and mothers who have malformed infants who survive, benefit from mourning their loss for an adequate time period before proceeding with their subsequent pregnancies (Solnit and Stark 1961; Garson et al 1987; Elliot and Hein 1978; Speck and Kenell 1980). Mothers of surviving children with major birth defects or mental retardation experience the loss of the anticipated healthy child and must adapt through a mourning process to accept the abnormal child. Adaptation is influenced not only by the capacity to resolve the psychological issues of guilt, failure and loss, but also by the daily physical and financial demands of caring children with defects.

Birth defect type was also associated with subsequent pregnancy rate. The highest subsequent pregnancy rates generally occurred among the mothers of children with lethal defects such as anencephaly or heart defects and the lowest rates were among mothers whose children had less severe defects. Mothers of non-surviving infants had higher rates than those whose infants had survived with the same defect. However, mothers whose infants had surgically correctable defects as cataract, gastroschisis had significantly lower pregnancy rate probably due to the emotional, physical and financial stress the parents have to undergo till the condition of the infant becomes stable and the management of the child becomes comparatively easier.

Further detailed study on other populations and socio-economic groups would be able to throw light on the biological associations between birth defects and subsequent pregnancy and fertility and delineate socio-cultural factors governing pregnancy from biological factors.

Table 1 : Demographic and Behavioral Characteristics of Case and Control Mothers.

Characteristics	Group I		Group II		Group III	
	n	%	n	%	n	%
Age in years						
11-19	978	11.57	52	15.07	45	3.31
20-24	2134	25.25	84	24.35	416	30.59
25-29	2879	34.07	119	34.49	598	43.97
30-34	1574	18.63	90	26.09	115	8.41
35+	85	10.47	—	—	186	13.68
<i>Completed educational level</i>						
Elementary	2496	29.54	129	37.39	347	25.51
High school	4358	51.57	189	54.78	669	49.19
College	1596	18.89	27	7.83	344	25.29
<i>Periconceptional employment</i>						
Yes	1465	17.34	129	37.39	413	30.37
No	6985	82.66	216	62.61	947	69.63
<i>Previous complicated pregnancy</i>						
Yes	1458	17.25	137	39.71	649	47.72
No	6992	82.74	208	60.29	711	52.58
<i>Chronic disease</i>						
Yes	1675	19.82	127	36.81	426	31.32
No	6775	80.18	218	63.19	934	68.68
<i>Planned pregnancy</i>						
Yes	4365	51.66	98	28.40	947	69.63
No	4100	48.51	247	71.59	413	30.37
<i>Fertility problem</i>						
Yes	3786	44.80	157	45.51	414	30.44
No	4664	55.19	158	54.49	946	69.56

Table 2 : Pattern of Adoption of Family Planning Mothers.

Time of adoption of family planning methods	Mother of singletons	Mother of twins	Total
Before the birth of a child with congenital defect.	698 (51.32%)	165 (12.13%)	863 (63.45%)
After the birth of a child with a congenital defect.	287 (21.10%)	210 (15.44%)	497 (36.45%)
Total	985 (72.43%)	375 (27.57%)	1360

Table 3 : Methods of family planning adopted by mothers prior to birth of a baby with congenital defect.

Mode of family planning	Mother of singletons		Mother of twins		Total	
	n	%	n	%	n	%
None	75	5.51	9	0.66	84	6.18
Absistence	27	1.98	10	0.73	37	2.72
Mechanical	395	29.04	138	10.15	533	39.19
Oral contraception	265	19.48	172	12.65	437	32.13
Therapeutic abortion	223	16.39	46	3.38	269	19.78
Total	985	72.43	375	27.57	1360	

Table 4 : Methods of family planning adopted by mothers after the birth of a baby with congenital defect.

Mode of family planning	Mother of singletons		Mother of twins		Total	
	n	%	n	%	n	%
None	529	38.39	172	12.65	641	47.13
Absistence	17	1.25	23	1.69	27	1.98
Mechanical	165	12.13	69	5.07	234	17.20
Oral contraception	185	13.60	96	7.06	281	20.66
Therapeutic abortion	89	6.54	15	1.10	104	7.65
Total	985	72.43	375	27.57	1360	

Table 5 : Pregnancy rates for case and control mothers following index births.

Group	Total	Total Pregnancy		Early pregnancy	
		N	%	N	%
Control mothers group I	8450	6474	76.61	976	23.38
Case mothers Group II & III	1360	416	30.59	944	69.41
Infants alive at 1 year Group II	345	166	48.11	179	51.88
Infant deaths/stillbirths Group III	1015	250	24.63	765	75.36

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I would like to express my sincere gratitude and thanks to Secretary, Ramakrishna Mission Seva Pratishthan, Vivekananda Institute of Medical Sciences, for allowing me to use the data for the present study and to Prof. A. R. Banerjee for initiating me into the study of congenital malformations.

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Designing of hand gloves in protection of hand wrist injuries among jute mill workers of West Bengal

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Abstract : The present research deals with the hand-wrist injuries of the jute mill workers. The aims of the present investigation is to study the various factors leading to hand-wrist injury in the jute mill workers and form a base for the designing of gloves to protect them to a certain extent from accidents. The data were collected from the records of Inspectorate of Factories as well as through questionnaire on jute mill workers. The part of the body injured mostly was found to be the index finger and the thumb. For designing gloves hand dimension of 30 jute mill workers were taken. Then percentile was calculated at P_{95} , P_{50} ; & P_5 of each dimension. To protect from hand-wrist injuries two gloves have been designed—DESIGN-1 and DESIGN-2. After designing, sample gloves were taken to 10 jute mill workers to get their opinion on the suitability of the gloves for their work. DESIGN-2 has been opted by them to be better suited to their work.

Key words : ergonomics, design, hand gloves, jute mill, workers.

Introduction

The word Ergonomics is derived from the Greek word 'ergon' meaning work & 'nomos' meaning laws. It can be defined as "Science, Technology & Art of Man at Work". It is an interdisciplinary subject and is closely allied with human physiology, psychology, anthropology, functional anatomy, occupational hygiene, industrial-design, cybernetics, information science, operation-research and with host of other disciplines including modern research trends. Ergonomics thus seeks to change the things for the betterment of capabilities, limitations and needs of people.

Jute industries are one of the oldest industries in India. Jute has traditionally been used for packaging. It is known as raw materials for sacks everywhere. Jute is used in various ways in industries — fashion, travel, luggage, furnishing, carpets, floor coverings, textiles, make-ups, etc.

According to the reports of Jute Manufacture Development Council (2001), in India average jute production is 8362 thousand bales; number of jute mills in India is 79, among which 59 are in West Bengal. Number of workers employed in jute mills (up to June 2001) is 1, 37,679. Average production of jute goods is 1605 thousand tones per annum. Average export of jute goods is 175 thousand tones per annum and average income from it is 6089 million rupees per annum. Average domestic demand for jute goods is moderately high; it is about 1422 thousand tones per annum. It is already reported that Jute industries are one of the prime hosts for machine accidents mainly at the hand wrist levels.

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An early definition of accidents was propounded by Lord Mc. Noughton, in which he defined an accident as "some concrete happening, which intervenes or obtrudes itself upon the normal course of employment". (Ridley, 1994).

Many industries keep internal accident records whether or not there is legal requirement to report them, due to management strategies, industrial economic relations etc., rather than drawing conclusion about safety of work-process or making change to accident policy (Kletz, 1976). The reason, as Hartwell (1977) noted, could be to avoid blame and responsibilities of accidents. Klausen & Iversen (1979) concluded in a study of 6 companies that most accident-forms were completed for insurance requirements rather than to promote safe working. Aim should be to prevent same accidents and negate accident hazards during design of new workstation, based on past accident information (Adams & Hartwell, 1977; Edwards, 1981; Pimble & O'Toole, 1990). Shortcoming in accident information is not restricted to design of accident form, but also how information gathered is treated. Extremely valuable data can be obtained by careful analysis of accident reports (Nicholson, 1985).

Apart from Accident Analysis a Questionnaire method is used to gather information on accidents in which questions are asked to workers regarding type of injury, time of injury, his/her occupation, cause of injury, etc. This information can be used for more detailed accident analysis.

The aim of the present study is the investigation of the various factors leading to hand-wrist injury in the jute mill workers and form a base for the designing of a protective device for giving them protection to a certain extent from the "too-often" accidents. This will lead to an improvement of the working conditions, safety and health and also efficiency of workers, ultimately leading to an increased productivity of the jute industries.

Designing of some protective device may be done with the aim of preventing or minimizing accidents, based on information obtained by accident analysis.

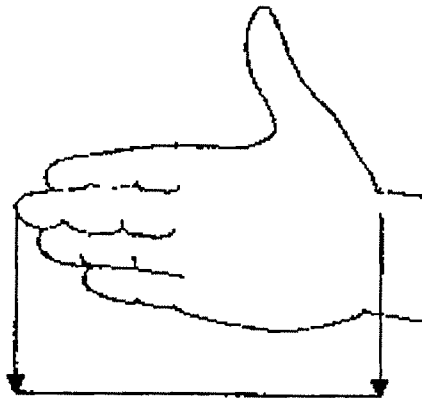
Materials and methods

The study was carried out by collecting accident records (Form No. 16/18) from Inspectorate of Factories Office. Data were obtained from 300 forms of hand injury cases related to jute mills. From these forms shift of work at which injury occurred, nature of injury, body parts involved, age, departments involved, time of accident and cause of accident were noted down.

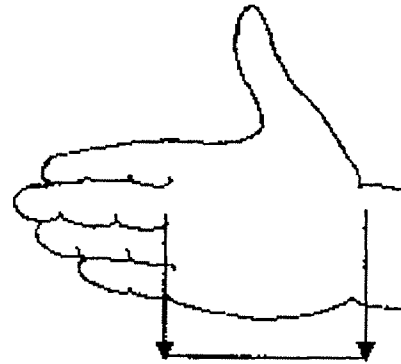
A Questionnaire study, developed by Ray and Gangopadhyay (2002), was done on 100 workers having hand-wrist injury, at the E.S.I: Hospital. The age of the workers, specific task being done during injury, years of experience, whether there was any machine malfunctioning, rush, illness, heat, etc were noted down.

Designing of gloves was done as a means of providing protection against the hand-wrist injuries. For designing gloves hand dimension of 30 jute mill workers were taken. The following dimensions were taken by Sliding Calipers & Measuring Tape and shown in Figure-1 : a. Hand length, b. Palm length, c. Fist length, d. Hand breadth with thumb, e. Hand breadth without thumb, f. Finger tip depth (of all 5 fingers), g. Finger tip width (of all 5 fingers), h. Hand depth at metacarpal, i. Hand depth at thumb base, j. Fist circumference, k. Grip inside diameter, l. Hand grip length.

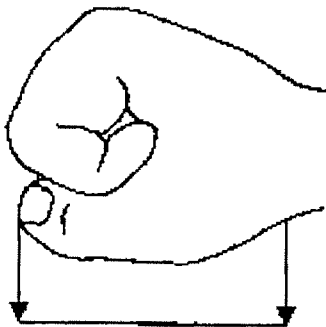
Then Percentile was calculated at P_{95} , P_{50} , & P_5 of each dimension for designing two types of hand gloves in three different categories depending on the variability of the user populations. After designing of hand-gloves, sample gloves were taken to 10 jute mill workers to get their opinion on the suitability of the gloves for their work.



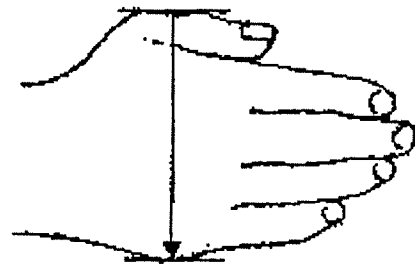
A. HAND LENGTH



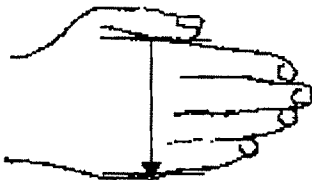
B. PALM LENGTH



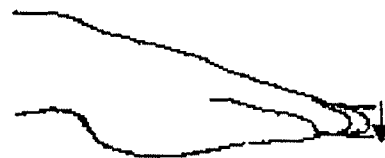
C. FIST LENGTH



D. HAND BREADTH WITH THUMB

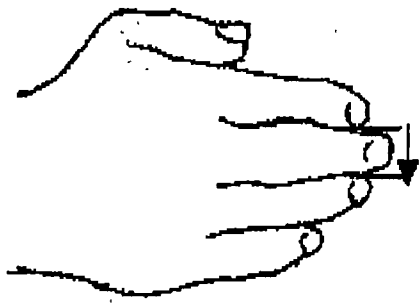


E. HAND BREADTH WITHOUT THUMB

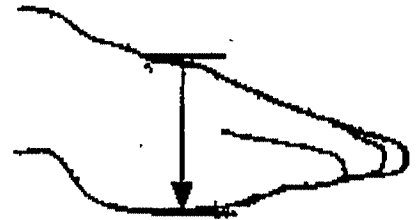


F. FINGER TIP DEPTH

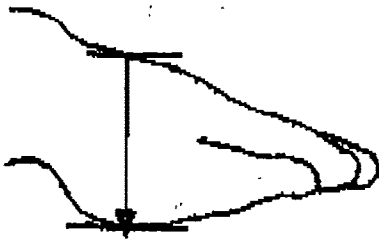
FIG 1 : DIFFERENT HAND DIMENSIONS



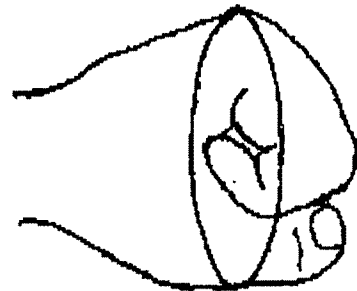
G. FINGER TIP WIDTH



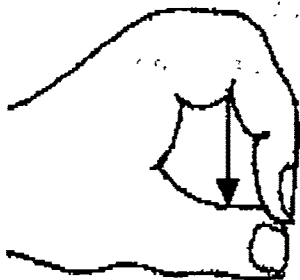
H. HAND DEPTH AT METACARPAL



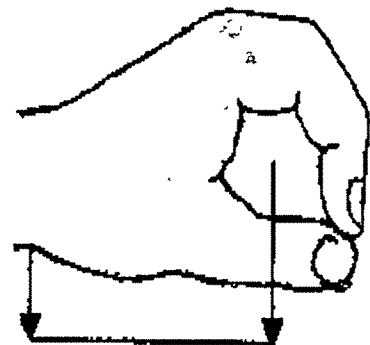
I. HAND DEPTH AT THUMB BASE



J. FIST CIRCUMFERENCE



K. GRIP INSIDE DIAMETER



L. HAND GRIP LENGTH

FIG 1 : DIFFERENT HAND DIMENSIONS

Results

From the analysis of questionnaire and accident reporting forms (Form No. 16/18) it was revealed that maximum laceration and cut type of accidents occurred at the index fingers of the workers in spinning department (Table 1).

Table 1 Analysis of accidents

Detail Information	From Form No. 16/18	From Questionnaire
Body Parts Involved	Right index finger 18.84%	Left index finger 16.53%
Name of Department	Spinning 24.68%	Spinning 24%
Nature of Injury	Laceration 24.68%	Cut 19.08%

On the basis of the above findings different hand dimensions were taken and their percentile values were calculated.

Table 2 Different hand dimensions

SL.NO.	HAND DIMENSIONS	PERCENTILE VALUE		
		P ₉₅	P ₅₀	P ₅
1	Hand length	191.55	181.1	170.8
2	Palm length	111.1	100.5	89.8
3	Fist Length	93.3	92.2	72.5
4	Handgrip Length	87.1	76.1	65.7
5	Hand Breadth With Thumb	111.1	91.2	89.7
6	Hand Breadth Without Thumb	100.9	79.9	61.7
7	Hand Breadth at Metacarpal	31.3	29.9	19.7
8	Hand Depth at Thumb Base	41.3	40.2	30
9	Fist Circumference	271	260.1	240.5
10	Grip Inside Diameter	32.2	22	20.6
11	Thumb Tip Depth	15.5	13	10.7
12	Index Finger Tip Depth	14.2	12.1	10.7
13	Middle Finger Tip Depth	14.3	12.9	10.7
14	Ring Finger Tip Depth	13.9	11.7	10.6
15	Little Finger Tip Depth	12.3	10.7	8.7
16	Thumb Tip Width	19.3	16.5	14.7
17	Index Finger Tip Width	14.7	12.7	11.6
18	Middle Finger Tip Width	15.7	13.6	12.6
19	Ring Finger Tip Width	15.2	13.1	11.6
20	Little Finger Tip Width	12.3	11.1	8.8

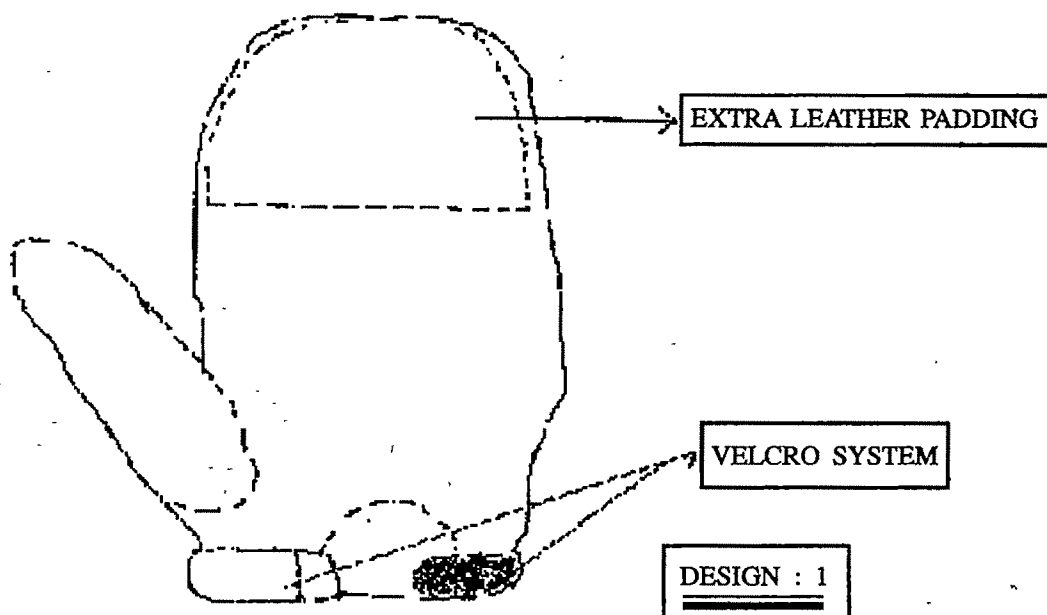


FIGURE : 2

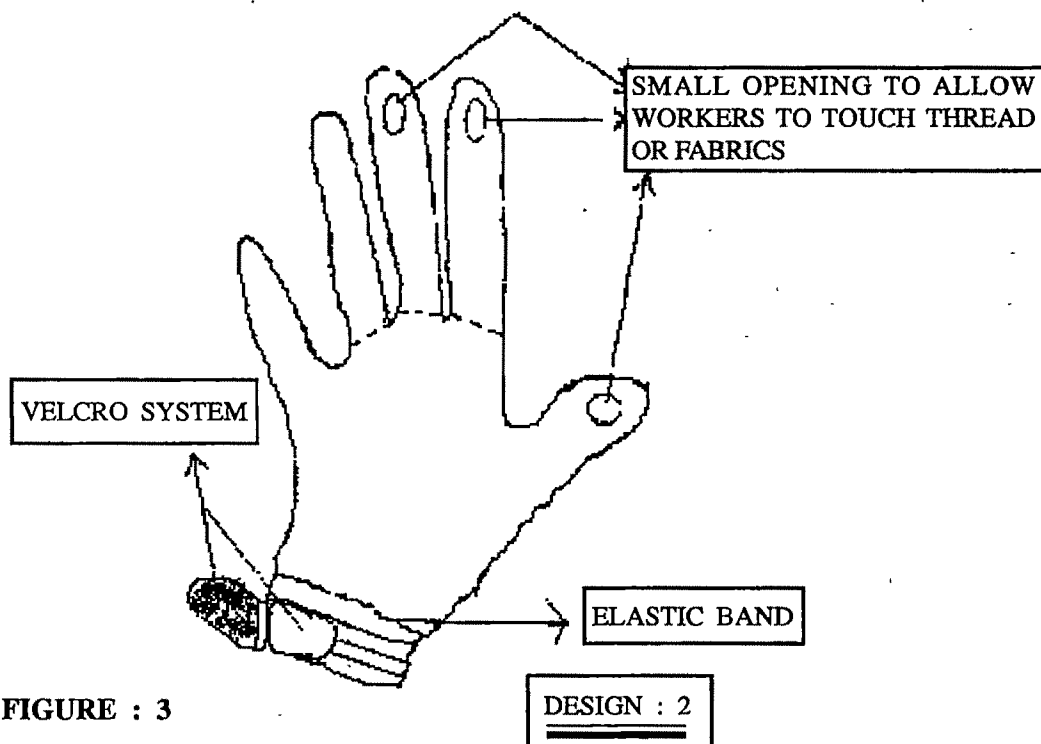


FIGURE : 3

On the basis of the measurements, hand-gloves were designed of 2 different models: DESIGN-1 and DESIGN-2 (Figure-2 and 3) and each model of 3 different sizes according to the 3 Percentiles obtained.

The material used was sweat leather, 0.8 - 0.9 mm thickness that would allow smooth working with the hands.

The gloves, after being made, were taken to the jute mill workers and their opinions were taken on the suitability of the gloves to their jobs. The following opinions were obtained:

Table 3 Response study on design .

SL.NO.	DEPARTMENTS	DESIGN - 1	DESIGN - 2
1	SPINNING	NOT SUITABLE (CAN'T JOIN THREAD)	COMFORTABLE (CAN JOIN THREAD, STOP GLASS)
2	CALENDARING	USEFUL (EXTRA LAYER OF LEATHER PROTECTS FROM ROLLER)	COMFORTABLE (GIVE SOME SORT OF PROTECTION FROM PRESSURE OF ROLLERS)
3	WEAVING	NOT SUITABLE (CAN'T JOIN THREAD, CAN'T HOLD FABRIC)	USEFUL(CAN MAKE USE OF FINGERS, FIBRE CAN BE HELD PROPERLY, PROTECTION FROM KNIFE INJURIES)
4	WINDING	NOT SUITABLE (CAN'T JOIN THREAD)	USEFUL (CAN MAKE USE OF FINGERS, FIBRE CAN BE HELD PROPERLY, PROTECTION FROM INJURY)
5	SEWING	NOT SUITABLE (CAN'T USE FINGERS)	USEFUL (CAN MAKE USE OF FINGERS, SACKS CAN BE HELD PROPERLY, PROTECTION FROM INJURY)
6	PREPARING	NOT SUITABLE (CAN'T USE FINGERS)	USEFUL (CAN MAKE USE OF FINGERS, PROTECTION FROM INJURY)
7	FINISHING	NOT SUITABLE (CAN'T USE FINGERS)	USEFUL (CAN MAKE USE OF FINGERS, PROTECTION FROM INJURY)

Discussion

As machines are in motion constantly and workers have to work in close association with these machines that run very fast and workers too are in a great hurry to produce more and more product, hence there are high chances of accident being caused by moving machinery parts.

The workers complained of extreme rush, heat and often machines not working properly. All these pressures had a cumulative effect on their cognitive performance due to excessive mental and physical stress, which has an inverted-U relationship with cognitive performance. As a result their efficiency declined, performance deteriorated and they often took unsafe decisions and performed unsafe act that led to hazards of injury.

They have to hold the jute fibre or thread during joining of threads in a machine, insert fibres into rollers or cloth into calendar and for these purposes their fingers especially thumb and index fingers are maximally susceptible to injury. It is very much required that these fingers be protected from machine rollers. Lack of experience and lack of training in the young and relatively new employees seemed to be a major factor and the young age group had to suffer more as compared to elderly age group.

The major problem of the Spinning workers seemed to be stopping the glass moving at a speed of 4400 turns per second with bare hands when threads broke. It seems some design alteration of the machine is required to prevent their injury, such as stopping the moving glass by using gears or switches. Machine maintenance is an essential requirement.

The gloves, after being made, were taken to the jute mill workers and their opinions were taken on the suitability of the gloves to their jobs.

From the opinion of the Calendar operators it is clear that Design 2 was comfortable to them but Design 1 was more useful for their specific work. On the other hand the workers of the Spinning, Winding, Weaving, Sewing, Preparing and Finishing departments opted for the Design-2.

For Calendar operators, who have to smoothen the cloth before inserting it into the roller, do not need to use all the five fingers and DESIGN-1 will be of better use to them.

For other departments such as Spinning, Weaving, Winding, Sewing, Preparing and Finishing, the workers need the use of all five fingers, and therefore DESIGN-2 will be of better use to them. They may even sometimes need to feel the touch of the jute fibres or threads on their skin and to allow them to do so, small windows were made near the tip of the thumb, index finger and middle finger of the hand gloves of DESIGN-2.

Majority of them opted for the DESIGN-2 as to be better suited to their work in comparison to DESIGN-1, which is opted for by the Calendar operators only. Thus, on the basis of their opinion we may select DESIGN-2 as a protective device for hand-wrist injuries. This study was meant to carry out the suitability of the gloves among the workers working in respective divisions.

Conclusion

In order to protect from hand-wrist injuries two gloves have been designed in this study — DESIGN-1 & DESIGN-2, among which DESIGN-2 has been opted by the jute

workers to be better suited to their work. Hence if management will allow the use of such gloves in the jute mills and provide workers with such gloves, then a reduction in the frequency of hand-wrist injuries may occur.

Though Ergonomics offer quite a lot of strategies for improvement of working condition, there is still a long way to go. The major issue seems to be a lack of knowledge and experience about a series of problems. One of the problems of industrializing countries is that they have a huge amount of technology transfer from industrialized ones. Moreover industries are more oriented towards mass production.

The way to escape accident is to anticipate 'preventive measures'. If the workers and the management together co-operate with each other and keep in mind the preventive measures, then accidents can be efficiently prevented and this is one of the main goals of Ergonomics in the forthcoming years.

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Reproductive and child health among the Namasudra of North 24 Parganas, West Bengal

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Abstract : Some important investigations on fertility, mortality reproductive and child health (RCH) have been carried out among the Namasudra Scheduled Caste populations residing in three villages namely Purana Bangaon, Paschim Ramchandrapur and Kansona in Bangaon block of North 24-Parganas district of West Bengal. The study reveals that adoption of family planning methods, check up of women during pregnancy, immunization of child, incidence of infant mortality are dependent on availability of health care facilities. The Namasudra caste group of people residing nearest to the sub divisional health centre possesses greater health consciousness than other two groups of populations residing away from the health centre.

Kew words : Reproductive and child health (RCH); Naasudra caste; 24 Parganas; West Bengal.

Introduction

The reproductive and child health (RCH) integrates all interventions of fertility regulation, maternal and child health with reproductive health of both men and women. In 1997, the Government of India launched its new reproductive and child health program. This program represents a much shift in the governments' policy moving as it does, from its past preoccupation of meeting sterilisation targets to the introduction of a decentralized participatory planning process based on community needs assessment. The countrywide RCH programs cover all extended range of services for unwanted fertility, maternal health, RTI/STI infection, child health and adolescent health. The new paradigm embodied in the RCH program echoes the deliberation of the International Conference on Population and Development (ICPD) held in Cairo in 1994.

It is difficult to ascertain why people want more children, as it is associated with economic, social, psychological considerations, which cannot be disentangled. The situation also varies from society to society and among individuals within a society. The Scheduled castes, Scheduled tribes and other backward castes form the economically weaker sections in the society. Their misery is compounded by poverty, ignorance, illiteracy, poor sanitation, and lack of safe drinking water and faith in traditional beliefs. Their knowledge system (beliefs, customs, rituals, tradition, and values) is closely associated with their health culture.

In National Health Policy, Scheduled caste group becomes one of the priority groups. A critical review of the literature clearly shows that there are only few valuable investigations on fertility and mortality differentials among the scheduled caste in our country and hardly any RCH study conducted ever among them (Mukhodhyay, 1981; Ghatak, 1990; Basu et al., 1992; Sarkar, 2000). Keeping the above in view the present study has been carried out among the Namasudra Scheduled caste population of the North 24 Parganas, West Bengal.

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Materials and Methods

The data of the present study were collected from the Namasudra Scheduled caste residing in three villages namely Purana Bongaon, Paschim Ramchandrapur and Kansona in Bangoan block of North 24 Parganas district, West Bengal. It is interesting to note that these villages are located in three geographic locations in this block, which are as follows:

Village I — Purana Bongaon: Located nearer to the block head quarter i.e. Bongaon town and sub divisional health center;

Village II — Paschim Ramchandrapur: located far from the sub divisional health center and

Village III — Kansona: located at a location farthest from the sub divisional health center.

Village Purana Bongaon is 3 kms away from Bongaon town whereas distances of Paschim Ramchandrapur and Kansona from this town are 7 kms and 12 kms respectively. Data were collected from a total of 876 ever-married Namasudra women. Out of which 202 were from Purana Bongaon, 426 were from Paschim Ramchandrapur and 248 were from Kansona. Data on fertility and mortality were obtained by genealogy. Further, an interview Scheduled consisting of multiple choice questions was used in order to obtain data on various aspects of reproductive and child health care practices among the Namasudra.

Results and Discussions :

Reproductive performance :

In table 1 number of mothers are shown according to villages, while in table 2 average number of live births of all the mothers are presented. It is interesting to note that average number of live births per mother increases in these villages as the geographical distances increases from the Block Headquarter. Average number is recorded to be lowest in Purana Bongaon village (3.08) and highest in Kansona village (3.71), whereas in Paschim Ramchandrapur village (3.54) an intermediate value is recorded. When these villages are clubbed together the average of live births is found to be 3.48 among them.

Infant mortality among the Namasudra residing in three villages are presented in table 3. It is interesting to note that like average live birth in case of infant mortality also an increasing trend is noticed in the villages as their geographical distance from the nearest urban center increases. Infant mortality is found to be 5.07% among the Namasudra. When the three villages are taken into consideration it is found to be lowest in Purana Bongaon (3.85%) and highest in Kansona (6.03%). Whereas in Paschim Ramchandrapur an intermediate value (4.83%) is recorded. It is however, interesting to note that in Kansona village the percent of infant mortality is recorded to be much higher than Purana Bongaon and Paschim Ramchandrapur village.

Health care :

In this section only the cases of last childbirth have been taken into consideration.

The reason of considering the last childbirth is that complete information regarding that particular delivery is fully available. But if all births are considered, firstly such information will not be available and secondly there will be many recall lapses. So, for the sake of accuracy of data, observations have been restricted on last childbirth. It has been restricted again for those births, which occurred at any time during the last four years i.e. from 1997-2000. In this context a sub-sample has been drawn which consists of 236 live births. Out of which 53 occurred in Purana Bongaon, 124 occurred in Paschim Ramchandrapur and the rest 59 occurred in Kansona. In the present study altogether 8 factors have been examined in these three villages. These are :

1. Education of respondents
2. Antenatal check-up of respondents
3. Immunization of respondents during pregnancy
4. Treatment of respondents during pregnancy
5. Treatment of child
6. Immunization of child
7. Family planning method adopted by the respondent and
8. Contraception used/using by mother.

In the following paragraphs each of the above aspects is described :

1. **Education of respondents :** Regarding education of respondents, it is noticed that significant differences exists between the respondents of Purana Bongaon and Paschim Ramchandrapur village and Paschim Ramchandrapur and Kansona village. But between Paschim Ramchandrapur and Kansona insignificant difference exists. It can be seen from table 4 that respondents of Purana Bongaon village are better educated than that of village Paschim Ramchandrapur and Kansona. The respondent of Paschim Ramchandrapur in turn is better educated than Kansona. A lower percentage of non-literate respondents are found in Purana Bongaon (26.41) and Paschim Ramchandrapur (25.81) than that of Kansona (33.90). It can be recapitulated that the percent of infant mortality are found to be considerably lower in Purana Bongaon and Paschim Ramchandrapur village than that of village Kansona.
2. **Antenatal check-up :** Antenatal care can contribute significantly to the reduction of maternal morbidity as well as mortality because besides offspring medical care it includes advice on correct diet and provision of necessary medicine to pregnant women (Nair et al., 2000). It is seen from table 5 that more than 90% of the respondents in Purana Bongaon avail regular medical check-up during pregnancy. The percentage of respondents in Paschim Ramchandrapur and Kansona village in turn is 60.48 and 62.71 respectively in this respect. When χ^2 test is performed it is found that both Paschim Ramchandrapur and Kansona villages significantly differ with Purana Bongaon. But between Paschim Ramchandrapur and Kansona insignificant difference exists.
3. **Immunization of respondents during pregnancy :** Immunization or expectant mother is considered to be an important aspect of health care of women during pregnancy. It is noticed from table 6 that more than 98% respondents in Purana

Bongaon and 96% in Paschim Ramchandrapur have taken tetanus injection during pregnancy. While in Kansona village, 89.83% respondents are found who have taken this. These indicate that respondents in all the villages are well aware of the benefit of this immunization. When χ^2 test is applied it is found that no marked significant differences exist among the respondents of these three villages.

4. **Treatment of respondents during pregnancy :** It is evident from table 7 that more than 92% respondents in Purana Bongaon and 86% in Kansona preferred treatment by medical persons during pregnancy. In contrast 65.52% respondents in Paschim Ramchandrapur preferred treatment by medical persons. Side by side only 7.51% respondents in Purana Bongaon preferred treatment by non-medical persons, while 35.48% respondents in Paschim Ramchandrapur have preferred this treatment. From the results of χ^2 test it appears that there is significant difference among the respondents between Purana Bongaon and Paschim Ramchandrapur as well as between Paschim Ramchandrapur and Kansona in this respect.
5. **Treatment of child :** In respect of treatment of child (medical and non-medical) significant differences exist among the children of the respondents of Purana Bongaon and Paschim Ramchandrapur and Paschim Ramchandrapur and Kansona, whereas between Purana Bongaon and Kansona insignificant difference was noticed. It is observed that more than 80% of the children of the respondents of Purana Bongaon and Kansona avail treatment by medical personnel, whereas 54% of the children in Paschim Ramchandrapur avail this. Thus, treatment by non-medical doctor is comparatively high in Paschim Ramchandrapur (45.96%) than that of Purana Bongaon. (18.86%) and Kansona (15.25%) village (Table 8).
6. **Immunization of child :** Immunization status of the child of the respondents is shown in table 9 according to villages. More than 47% of the children in Purana Bongaon have completed their immunization, while in Paschim Ramchandrapur and Kansona 25.8% and 23.73% of the children have completed immunization. A high percentage of children have partly completed immunization in all three villages. However this percentage is much higher in Paschim Ramchandrapur (60.48%) and Kansona (61.02%) than that of Purana Bongaon (43.40%). When χ^2 test is performed it is seen that there is significant difference among the children of Purana Bongaon and Paschim Ramchandrapur and Purana Bongaon and Kansona. But between Paschim Ramchandrapur and Kansona insignificant difference is noticed in this respect.
7. **Family planning methods adopted by respondents :** It reveals from table 10 that only 7.25% of the respondents in Paschim Ramchandrapur have adopted family planning methods. Whereas in other two villages these value is found to be quiet encouraging. In Purana Bongaon and Kansona village more than one-fourth of the respondents have adopted family planning methods. Respondents of Purana Bongaon and Paschim Ramchandrapur, and Paschim Ramchandrapur and Kansona differ significantly, while between Purana Bongaon and Kansona there is insignificant difference in this respect.

8. **Contraception used by respondent :** In respect of contraception used by the respondents it is found from table 11 that most of them used oral pill to restrict their pregnancy. This percentage is 58.49, 72.58 and 72.88 in Purana Bongaon, Paschim Ramchandrapur and Kansona villages respectively. However, a good percentage of husbands (33.96%) are found in Purana Bongaon to use condom as contraceptive. This percentage is moderate in Paschim Ramchandrapur (23.39%) and low (16.95%) in Kansona village. A few numbers of them also use other methods in this respect. When χ^2 test is done it is found that there exists no significant difference among the respondents in these three villages.

Conclusion :

It is well established that availability of health care facilities diminishes while the geographic distances of the location increases from the nearest urban center. It can be recapitulated that these three villages under study are located in three different geographic locations from the block head quarter. It appears that the Namasudras of Purana Bongaon largely depend on medical treatment like immunization of child, treatment by professional medical doctors rather than by the quacks. Besides it is also noticed that a good number of couple among them have adopted family planning methods. Side by side, the Namasudras of Paschim Ramchandrapur are in better position in respect to medical check-up of women during pregnancy and treatment of the child than the Namasudras of Kansona. Consequently infant mortality is found to be lowest among the Namasudras of Purana Bongaon and highest in Kansona, whereas the Namasudras of Paschim Ramchandrapur stand in between in this respect.

Thus in fine, it can be said that due to the nearness of the urban center the Namasudras of Purana Bongaon certainly enjoy better medical and public health facilities than their counterparts in other two locations. Side- by side, due to the relative proximity of the village Paschim Ramchandrapur to the urban center, the Namasudras in this location enjoy comparatively better medical facilities than the Namasudras of Kansona village. This buttressed the incidence of infant mortality among the study population residing in three different locations, which is also indicative of greater health consciousness among the Namasudras of Purana Bongaon than other two villages and comparatively less consciousness of health among the Namasudras of Kansona than other two villages.

Table 1 : Number of mothers according to villagers

Village	Total number of mothers
Purana Bongaon	202
Paschim Ramchandrapur	426
Kansona	248
Total	876

Table 2 : Averege live births according to village

Village	No. of mothers	Toatl no. of live births	Average live births per mother $\pm$ S.E.
Purana Bongaon	202	623	3.084 $\pm$ 0.1323
Paschim Ramchandrapur	426	1510	3.5446 $\pm$ 0.1060
Kansona	248	921	3.7137 $\pm$ 0.1500

Table 3 : Infant mortality according to village

Village	No. of mothers	Toatl no. of Live births	Neo-natal deaths	Post neo-natal deaths	Total infant deaths	Rate of infant mortality
Purana Bongaon	202	623	5	19	24	38.52
Paschim Ramchandrapur	426	1510	43	30	73	48.34
Kansona	248	921	26	32	58	65.97
Total	876	3054	74	81	155	50.75

Table 4 : Education of respondents in three villages

Educational Status	Village : Purana Bongaon		Village : Paschim Ramchandrapur		Village : Kansona	
	Numbers	%	Numbers	%	Numbers	%
Illiterate	14	26.41	32	25.81	20	33.90
Primary	21	39.62	78	62.90	16	27.12
Secondary and Above	18	33.96	14	11.29	23	38.98
Total	53	100.00	124	100.00	59	100.00

 χ^2 Values :

Purna Bangaon (vs) Paschim Ramchandrapur : 14.16, d.f. = 2 : significant
 Purana Bangaon (vs) Kansona : 2.029, d.f. = 2 : not significant
 Paschim Ramchandrapur (vs) Kansona : 26.07, d.f. = 2 : significant

Table 5 : Antenatal care of respondents in three villages

Antenatal check up of the respondents during pregnancy	Village : Purana Bongaon		Village : Paschim Ramchandrapur		Village : Kansona	
	Numbers	%	Numbers	%	Numbers	%
Yes	48	90.57	75	60.48	37	62.71
No	5	9.43	49	39.52	22	37.29
Total	53	100.00	124	100.00	59	100.00

χ^2 Values :

Purna Bongaon (vs) Paschim Ramchandrapur : 15.48, d.f. = 1 : significant

Purana Bongaon (vs) Kansona : 11.72, d.f. = 1 : significant

Paschim Ramchandrapur (vs) Kansona : 0.08, d.f. = 1 : not significant

Table 6 : Tetanus injections taken by the respondents in three villages

Titenus injections taken by the respondents during pregnancy	Village : Purana Bongaon		Village : Paschim Ramchandrapur		Village : Kansona	
	Numbers	%	Numbers	%	Numbers	%
Yes	52	98.11	119	95.97	53	89.83
No	1	1.89	5	4.03	6	10.17
Total	53	100.00	124	100.00	59	100.00

χ^2 Values :

Purna Bongaon (vs) Paschim Ramchandrapur : 0.52, d.f. = 1 : not significant

Purana Bongaon (vs) Kansona : 3.28, d.f. = 1 : not significant

Paschim Ramchandrapur (vs) Kansona : 2.673, d.f. = 1 : not significant

Table 7 : Treatment of respondents during pregnancy in three villages

Treatment of respondents during pregnancy	Village : Purana Bongaon		Village : Paschim Ramchandrapur		Village : Kansona	
	Numbers	%	Numbers	%	Numbers	%
Medical	49	92.49	80	65.52	51	86.44
Non-Medical	4	7.51	44	35.48	8	13.56
Total	53	100.00	124	100.00	59	100.00

 χ^2 Values :

Purna Bongaon (vs) Paschim Ramchandrapur : 14.65, d.f. = 1 : significant

Purana Bongaon (vs) Kansona : 1.05, d.f. = 1 : not significant

Paschim Ramchandrapur (vs) Kansona : 9.43, d.f. = 1 : significant

Table 8 : Treatment of child of the respondents in three villages

Treatment of child	Village : Purana Bongaon		Village : Paschim Ramchandrapur		Village : Kansona	
	Numbers	%	Numbers	%	Numbers	%
Medical	43	81.13	67	54.03	50	84.75
Non-Medical	10	18.86	57	45.96	9	15.25
Total	53	99.99	124	99.99	59	100.00

 χ^2 Values :

Purna Bongaon (vs) Paschim Ramchandrapur : 11.60, d.f. = 1 : significant

Purana Bongaon (vs) Kansona : 0.43, d.f. = 1 : not significant

Paschim Ramchandrapur (vs) Kansona : 16.35, d.f. = 1 : significant

Table 9 : Immunization of child of the respondents in three villages

Immunization of child	Village : Purana Bongaon		Village : Paschim Ramchandrapur		Village : Kansona	
	Numbers	%	Numbers	%	Numbers	%
Completed	25	47.17	32	25.80	14	23.73
Partly Completed	23	43.40	75	60.48	36	61.02
Not taken	5	9.43	17	13.71	9	15.25
Total	53	100.00	124	99.99	59	100.00

 χ^2 Values :

Purna Bongaon (vs) Paschim Ramchandrapur : 7.74, d.f. = 2 : significant

Purana Bongaon (vs) Kansona : 6.78, d.f. = 2 : significant

Paschim Ramchandrapur (vs) Kansona : 0.74, d.f. = 2 : not significant

Table 10 : Family Planning method adopted by the respondents in three villages

Family Planning method adopted	Village : Purana Bongaon		Village : Paschim Ramchandrapur		Village : Kansona	
	Numbers	%	Numbers	%	Numbers	%
Yes	15	28.30	9	7.25	15	25.42
No	38	71.70	115	92.74	44	74.58
Total	53	100.00	124	99.99	59	100.00

 χ^2 Values :

Purna Bongaon (vs) Paschim Ramchandrapur : 14.03, d.f. = 1 : significant

Purana Bongaon (vs) Kansona : 0.12, d.f. = 1 : not significant

Paschim Ramchandrapur (vs) Kansona : 11.59, d.f. = 1 : significant

Table 11 : Contraception used / using by the Couples in three villages

Contraception used / using	Village : Purana Bongaon		Village : Paschim Ramchandrapur		Village : Kansona	
	Numbers	%	Numbers	%	Numbers	%
Condom	18	33.96	29	23.39	10	16.95
Oral Pill	31	58.49	90	72.58	43	72.88
Others	4	7.55	5	4.03	6	10.17
Total	53	100.00	124	100.00	59	100.00

χ^2 Values :

Purna Bongaon (vs) Paschim Ramchandrapur : 3.54, d.f. = 2 : not significant
Purana Bongaon (vs) Kansona : 4.32, d.f. = 2 : not significant
Paschim Ramchandrapur (vs) Kansona : 3.28, d.f. = 2 : not significant

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Folk cognition of health, food and aging : The cases of the Ho and The Santar

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Abstract : The Santar and the Ho are called in our country as *Adivasi*. The *Adivasi* as such in India is divided into many groups with different cultural identities with varied ethnic strengths. The Ho and the Santar through its pattern maintenance, tension management in a vivid cultural situation, through attainment of goal expressed and reflected their cognition of food, health and aging.

Health, food and aging are topics receiving unprecedented space and time in all media. Health and aging have been concerned here of the folk in determining the cognition of the Santar and the Ho about the process of physiologic aging occurs. Over a decade the researcher has been attending through cognition of "food for health" and "food for hunger" to establish the requirements of nutrient according to chronological age. The data were collected from aged who ranged in age from 60 years to 80 years. Data on food consumption and value of food as cognized indicate deficiencies in the nutrient intake by older group. However, interpretation of these deficiencies is dependent entirely upon the standard used.

The data collected from the villagers under study are demonstrating cause and effect relationships between health, food and successful aging among these folk people which often indicate unexplainable truth.

Key words : folk cognition, ethnoscientist, *baske daka*, *sibil*, hot food, cold food.

Area of study

The Santar and the Ho portray the fact that even in the face of their paucity of knowledge in understanding the positive result from good nutrition they recognize the causal relationships of food and health. This is also true in regard to prevention of diseases and disabilities of old age and physiological aging. The folk are defined here as populations who are living in the countryside. In order to view folk cognition of food and aging villages named Amainager, Kadamdihi and Chakulia are used as the framework within which the folk cognition empirically was attempted. These three villages are located in Ghatsila in east Singhbhum district of Jharkhand state very near to Surbarnarekha river. The residents are mostly the *Adivasis*. The word cognition means "to know". It denotes the knowledge to draw upon, to make sense of environment. Cognition is usually contrasted with perception. The study of cognition is the study of how human knowledge is learnt, stored and retrieved. Here, what the folk have learnt and what they passed onto the next generation have been recorded. It is concerned with culture in some aspects of cognition but not all (Barnard and Spencer 2002 : 108) The folk in question existed here with 23 aged souls in Amainager, 29 aged individuals in Kadamdihi and 27 aged persons in Chakulia. The other castes residing in these villages comprised of all together 45 aged persons. The empiricism was confined

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to the aged Santar and the Ho whose population together constituted of 79 souls of 60 years and above.

The folk embrace the belief that *Bhageya hodom* (good health) exhibits no physical indisposition either by the wrath of *Bonga* (spirit) or by attack of *Dain* (witches) or diseases like *Lok adokek* (diarrhoea) *Boho hasu* (headache), *Pali rua* (malaria) due to intake of *Sia jomi Suia jome* (rotten food) or disease caused by mosquito bite. *Huru* (paddy), *Munga arak* (*Moringa oleifera*), *Karida arak* (*Ipomoea aquatica*), *Puroi arak* (*Basilla alba*), *Jil or Jilu* (meat) and *Haku* (fish) are *Bhageya jome* (good food). The meaning of good food covers individuals ability to find, prepare, digest and metabolize specific food and their component nutrients.

Information was culled from the ethnoscientists. The ethnoscientists are conceived here as the knowledgeable folks who from their wisdom can explain the cause and effect of related phenomena, event and processes through experimental verifications. The ethnoscientist informants reported the author that “when they take *Bhageya jome* (good food), they feel it from its *Sibil* (taste) and its effect on body. It usually gives strength, raise desire to work induce no fatigue after ploughing and other works. When an *Ajar* or a sick person is given *Sim jil* (chicken meat), different kinds of *Jaw* (fruits) such as *Kaira* (banana), *Angur* (grapes). *Bedana*, *Apel* (apple), *Lolo daka* (warm rice), *Raher dal* (*Cajanus cajans*), *Rabda* (*Phaseotus aureus*) and *Rase haku* (fish curry) almost in *Teke* (boiled) form he improves from *Ajar* (indisposed) condition”. On the other hand *Sukri jil* (pig meat), *Merom jil* (mutton) and *Baske daka* (soaked rice) are proscribed to the *Gadam hadam* (old man) and *Ajar* person. Even *Handia* (rice beer) is prohibited to them (Sengupta *et. al.* 2003a). The Santar and the Ho exhibited their speciality in selection of edible and inedible varieties. Individual and general, permanent and temporary proscriptions on certain food may express a person's relationship to his or her environment (Manderson 1986:8).

Folk food items

Data from the present investigations suggest that persons who are remaining slender throughout their lifetime usually continue to live more older than those who become obese (*mota*). Many informants seek longevity from diets, music and dance.

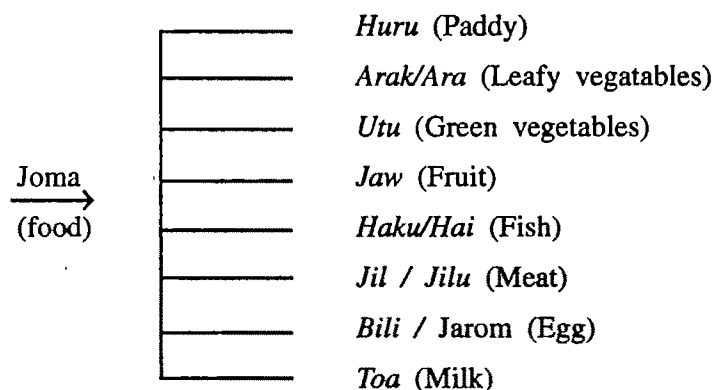


Figure 1 : Classification of food items.

Happy living increases longevity. The average age at death among the Santar and the Ho are in excess of 70 years. This suggest that frugal nutrition, limited food (*Etang jome*) and appropriate (*Daria*) physical work either combined or independently are considered as the factors responsible for good longevity of these particular groups (Stunkard 1976). Data on food varieties and food intake conclusively implicate good food (*Bhageya jome*) as a desirable root to attain advanced old age. These concepts and practices summarize other behavioral characteristics. *Sukri jil*, (pig meat) *Meram jil* (mutton) and *Lolo Jome* (hot food) are proscribed to the aged and persons who are suffering from *Rua* (fever) and which have decisive influence on longevity. Like the folk in question, our media, of course assign importance to various diets for longevity. The folk presented their concepts of food choice for prevention and management of diseases and disabilities. It was noted that the folk perceive the cause and effect of nutrition and diseases and also interrelationships between the two. They indicated the definite role of the specific food items on particular disease but they seldom explain the scientific reason. They attributed causal relations. Scientific approaches to food-health-aging triad demonstrate that folk's attribution of causal relations is true. The importance of diet in the management of diabetes in pre-insulin era and its interdependency are acceptable. Management of patients of osteoporosis suggests that increments in daily calcium intake may modify its course. Rice-diet is suggested for control of cardiovascular diseases because of its extremely low salt content (Watkin, et. al 1950). Thus dietary control of low cholesterol and fat was suggested for coronary patients.

Regular diets of the Santar and the Ho are composed of *Huru* (rice), *Rahet* (root), *Arak* (leafy vegetables), *Alti* (Arum), and *Utu* (vegetables of different types). In Santali and Ho dialects *Utu* denotes both raw vegetables and cooked curry (fig. 1). The main food of the folk is rice which is taken in different prepared conditions : *Baske daka* (soaked) rice, *Lolo daka* (warm cooked rice), *Rohar daka* (cooked rice) and *Maddi daka* (gruel rice). Besides *Sia daka* (fermented rice) is not eaten but is used for preparing *Handia* (rice beer). The folk applied their knowledge gathered through experiences while consuming rice of different forms. A normal adult with perfect health condition most frequently consumed *Baske daka*. But they never allowed *Rua Kanah* (sick person) to take *Baske daka* or *Basi mandi*. If a person suffers from *Ruhe* (disease) or *Thetna husui* (pain in knee), he is not allowed to take soaked rice. This proscription establishes the fact that the folk never suggest to eat *Baske daka* or *Basi mandi* as this variety was *Esu dah kana* (containing much water) which may cause inconvenience to the said patient. (Sengupta 2003 : 119). The present investigation was confined to the study of folk cognition of health, food choice, food habit and aging to establish interdependency of them as a matter of causal relations. The investigation was restricted to 'aged' who ranged in age from 60 years to 80 years. These small groups of persons were seen under a normal folk style of living for an experimental conditions. Data on food choice and habit. proscription and prescription of food indicated that the folk studied the effect of a specific food item on the body and thus culturally supported its consumption by a particular group of people. The science of nutrition proceeds experimentally to assign importance of a particular food item to human body (Goodman and Smith 1976). *Lolo jome* (hot food) and *Riya jome* (cold food) dichotomy suggested the knowledge of the folk on food choice for health (Jensen 1966). Levi Strauss (1969)

argued that the classification of hot and cold was linked up with the opposition of nature and culture. Manderson (1986 : 143) subscribes that cold food is closure to nature, hot food is usually cooked food and closure to culture. The said Santar and the Ho ethnoscientists relate the *Lolo* and the *Riya* food with the health and aging. Hot food is restricted to the aged and cold food is prescribed to them in normal condition (fig.2).

Hot and cold food

The meaning of aging is protean to the folk depending on the wisdom and knowledge of the definer. To some informants aging suggests a phase of life associated

Figure 2 : 'Hot' and 'Cold' dichotomy : (according to field data, the classification of hot food and cold food)

<i>Lolo joma</i> (hot food)	<i>Riya joma</i> (cold food)
a) <i>Cha</i> (tea)	a) <i>Baske daka</i> (stale rice)
b) <i>Mohua</i> (Country liquor)	b) <i>Didari</i> (palm fruit)
c) <i>Bili</i> (egg)	c) <i>Papaiya</i> (papaw)
d) <i>Jilu</i> (meat)	d) <i>Sejo</i> (wood apple)
e) <i>Haku</i> (fish)	e) <i>Mandar Bili</i> (custard apple)
f) <i>Rohoy daka</i> (dry cooked rice)	f) <i>Kul</i> (plum)
g) <i>Lolo daka</i> (warm rice)	g) <i>Khejure</i> (date palm)
h) <i>Piyaj</i> (onion)	h) <i>Kairo</i> (banana)
i) <i>Rasun</i> (garlic)	i) <i>Daab</i> (green coconut)
j) <i>Kanthar</i> (jack fruit)	j) <i>Pulpul</i> (parbal)
k) <i>Nariel</i> (cocoanut)	k) <i>Bengar</i> (brinjal)
l) <i>Masur</i> (lentils)	l) <i>Konghda</i> (gourd)
m) <i>Rohor marich</i> (dry chilly)	m) <i>Jhinga</i> (ridged gourd)
	n) <i>Etchar</i> (green jack fruit)
	o) <i>Palak Ara</i> (spinach)
	p) <i>Bherua</i> (lady's finger)
	q) <i>Kahanda</i> (pumpkin)
	r) <i>Hariar marich</i> (green chilly)

with decline of physical strength to work for earning. Some of the informants defined aging as a phase of life when the individual is left by the offspring, saddened and frightened by ever increasing ages and mortality and gradual loss of his physical and mental strength. Many informants point out that aging is characterized by the prevalence of many diseases: sometimes chronic and acute. The general belief is that when intake of food decreases the body resistance power falls. Therefore food items and intake of food are important. All items of food, are not tolerable to the *Hodam* (body) and as a result devoid of maintenance of strong health. In folk cognition of the Santar and the Ho, the concept of biological scientists regarding aging is practically non-existent. The biological scientist is truly gerontologist devoting them to the study of physiological, biochemical and pathologic phenomena associated with aging.

Gadam hadam (old man) and *Gadam budi* (old woman) show the changes associated with aging when they are called "aged" as per folk concept. The folk defined the aged as those who have survived through at least three quarters of the total life of 80 years span. The concept of aged explains the mutual relations of *Bhageya jome* (good food) and *Gadam hadam*. Similarly the "elderly" term is applied to those who have survived at least two-third of the total life span. Many of them are continuing work in their chosen agricultural activities. They sometimes acutely suffer from diseases like *Dah syan* (diarrhoea), *Puti* (constipation), *Lach hasu* (belly pain), *Jon rapudok* (fractured bone), *Sukumpit* (indigestion), *Khok mande* (cough and cold). The term *Mayang kundi hasu* (heart pain), *Boha hasu* (forehead pain) are associated with elderly.

Bhageya jome (good food) is the cognition of food categories related to health. The term *jome* (food) is familiar to everyone. To relate the food with the improvement of health, food must be thought of in terms of production. Production in the folk society is depended upon favorable climate and appropriate raining. The health as it relates to *Bhageya jome* (good food) is explained from two perspectives : firstly, appropriate *Bhageya jome* quantitatively is essential to the maintenance of *Bhageya hodom* (good health) and secondly sustenance of good health is possible through the prevention of diseases and disabilities and appropriate treatment of diseases through *Sakha* (herbalists) and *Ojha* (spirit finder). These are essential for the maintenance of good health status. There is consensus among the folk ethnoscientist informants that the food requirement of a man is related to physical work. A characteristic of aging is a gradual decline in food intake and activity. They believe, it starts at the middle age. Hence it is their conjecture that if the intake of food is not lowered in proportion to less involvement in physical work, the aged person will suffer from *Sukumpit* (indigestion) and excess food intake will cause accumulation of *Itil* (fat). Therefore a person of old age is encouraged to participate in agricultural activities, caring of live stocks, attending market etc. as a measure of physical work in order to allow the excess of food intake to be digested properly if appropriate physical labour is done. The food stuff of a folk has average food value as it consists of *Huru* (rice), *Arak* (leafy vegetable), *Utu* (green vegetable), *Haku* (fish), *Sim jil* (chicken) and *Rahet* (root) of different varieties which are readily available and after controlled consumption of these food items the consequences of obesity are not visible. Effect of *Daria jome* (large quantities of food) is expended in performances of good physical work. They opined that they seldom allow their *Gadam buda* (grand father), *Gadam budi* (grand mother), *Gonguba* (father's elder brother) and other aged persons to spare time sluggishly and consume large quantities of food. They are allowed to take *Etang jome* (restricted diet). This sometimes cause misunderstanding between the son and the aged persons in the family. The *Orah* (household) members thus face the situation of misunderstanding centering round the aged persons. Easily digestible diets are suggested for the aged persons considering their metabolic condition and ability to consume regular food. The ethno scientist informants confidently point out that in their society the impact of *Mayang kundi hasu* (cardiovascular disease) is hardly visible. The author was requested during his field work by an ethno scientist with his smiling face to note the participation of elderly people in different forms of activities to keep their health *Bhageya* (good).

Folk concept of health

The Santar and the Ho impressed the author with their concept of health. They defined health usually synonymous with the absence of *Hasu* (disease). Illness is defined as the impairment of their mobility and the ways of life to which they have become accustomed. Furthermore, the folk also indicate that the old age necessarily is characterized by *Rua* (physical indisposition), disability, immobility, faulty perception, loneliness from which death is only escape. Aging is usual and its absolute prevention is not culturally prescribed. The above discussion portrayed the fact that their food pattern is culturally prescribed and proscribed in such a manner that reflect the requirements of aged and their appropriate food. In folk culture the large quantities of animal protein intake are proscribed to the aged when compared to the young.

Aging is a biological process as explained by number of different theories. They compete to each other for popularity. No one of them has become the front runner. Aging is the phenomenon of pluralistic origin. Nonetheless to understand the phenomenon and to evaluate the impact of environmental factors such as nutrition on it, folk's familiarity with the aspect of aging is noteworthy.

It is natural that one will become aged, old and die. Nothing can be done to prevent the inexorable consequences of aging and its associated diseases and disabilities. The Santar and the Ho food habit is culturally fixed. This food habit explains the adequacy of nutrition through fulfillment of caloric requirements. Their prescription and restriction of food to the aged and the children are the way to the maintenance of good health and to the prevention of diseases and disabilities. Furthermore, food is a medium of exchange a symbol of various relationships and a means of expressing a range of emotions in concrete form (Reid 1986: 49) Even under lack of hard data, the accumulated soft data are sufficient to suggest the folk belief that food choice and prescription are the bedrock upon which prevention of diseases, disabilities and premature aging are structured. Good health is the outcome of good food. The Santar and the Ho recognize good health as the outcome of personal care. Why the folk consume food? Essentially their *Joma* (food) satisfy two desires : *Joma for Rangach* (hunger) and *Joma for Hodom* (body). They explained the value of food in positive terms (de Garine 1972:). Balakram Soren, an ethno scientist tried to explain how health was a factor of consideration under individual control. He pointed out that his father-in-law aged about 70 years, imposed several restrictions on food intake. He used to take good quantity of food twice a day. He used to take *Baske daka* (soaked rice), *Lolo daka* (warm rice), *Munga arak* (Moringa oleifera), *Raher daal* (a kind of pulses), *Chuno haku* (small fish) and *Utu* (green and other vegetables). *Baske daka* supplies required energy from carbohydrate and water, *Munga arak*, mixed vegetables supply minerals and vitamins and *Chuno haku* is the protein source. Balakram further confirmed that they never allow the old person to consume large quantities of *Sim jil*, *Merom Jil* and *Sukri jil* as the folk society gather the knowledge that during old age large quantities of protein are not required. Food is abundant in the villages under study. The inhabitants of the villages know which type and kind of food conducive to the body as well as the quality and quantity of the food taken daily. (Sengupta 2003). However, it reflects some of the determinants which control the nutritional environment. The components of health-food-aging triad are realized by the

folk in question. This knowledge on triad indicates their health status, concept of food and gradual movement toward aging (Sengupta and Kar 2004). The consideration of usual food patterns of the folk raised two issues: (a) the information viewed from scientific treatises can be comparable with the information derived from conventional intake of food items by the folk and (b) the explanations which, the ethno scientist presented here are essentially the results of causal relationships and prolonged experimental verification of the concerned folks.

In forgoing pages the concepts of the Santar and the Ho regarding aging and their notions about elderly persons are expressed as a continuation of the folkways of living for generations. Getting of more and appropriate data can only improve the development of more acceptable, effective and cost-effective methodology with the application of scientific information on folk concept of aging as a process. However, information about health, food and aging triad presented here in many instances are unique. It simply offers the senses of the folk about this triad.

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